PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2000-081601

(43)Date of publication of application : 21.03.2000

(51)Int.Cl. G02F 1/13
G02F 1/1335
G03B 21/00
G09F 9/00

(21)Application number : 11-180900

(22)Date of filing : 25.06.1999

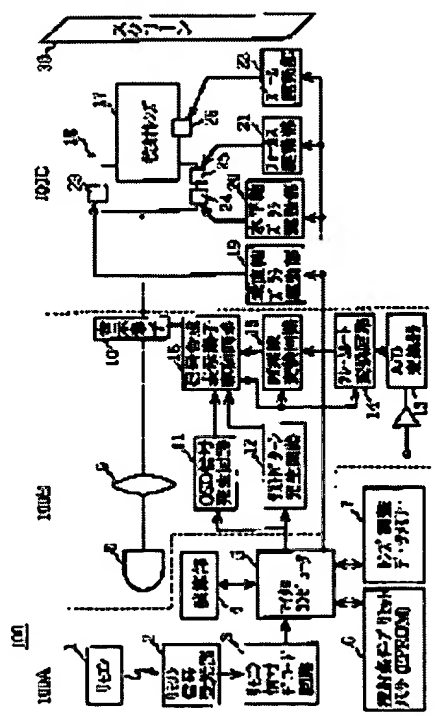
(71)Applicant : MATSUSHITA ELECTRIC IND CO LTD

(72)Inventor : KAWASHIMA MASAHIRO
GYOTEN TAKAAKI

(30)Priority

Priority number : 10180129 Priority date : 26.06.1998 Priority country : JP

(54) PROJECTOR



(57)Abstract:

PROBLEM TO BE SOLVED: To provide a projector which is easily installed and adjusted.

SOLUTION: A microcomputer 5 refers to correlation data showing correlation between the kind of a projection lens, a projection screen size and an optimum projection distance stored in a projection condition preset memory 6 when a projection condition is inputted to the microcomputer 5 through a remote controller 1 so that an optimum projection lens satisfying the projection condition inputted and a projection distance at that time are displayed on a screen 30. A regulator attaches the optimum lens. and sets the position of the projector 100 at the optimum projection distance. The microcomputer 5 calculates the zooming driving quantity and the focusing quantity of the projection lens by the correction data so as to satisfy the projection screen

size, so that the projection lens 17 is automatically driven through a focusing driving part 21 and a zooming driving part 22.

LEGAL STATUS

[Date of request for examination]	20.01.2003
[Date of sending the examiner's decision of rejection]	
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	
[Date of registration]	
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

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CLAIMS

[Claim(s)]
[Claim 1] The projector characterized by to have the lens driving means which is the projector which projects the image displayed on the image-display section on a plane of incidence-ed through a projector lens, and drives said projector lens, a reception means receive the input of at least one projection condition, a parameter decision means determine the control parameter of a lens driving means based on said received projection conditions, and the control means that control said lens driving means based on said determined control parameter.
[Claim 2] Said parameter decision means is a projector according to claim 1 characterized by having a storage means to store the correlation data in which relation with the control parameter for satisfying two or more projection conditions and each projection conditions is shown, and determining said control parameter based on the correlation data concerned.
[Claim 3] The lens driving means which is the projector which projects the image possible [two or more kinds of projector lenses] and displayed on the image display section on a plane of incidence-ed through the equipped projector lens, and drives said projector lens with which it was equipped, At least one projection condition and a reception means to receive each input of the class of projector lens with which it equips, The projector characterized by having a parameter decision means to determine the control parameter of a lens driving means based on said received projection conditions and class of projector lens, and the control means which controls said lens driving means based on said determined control parameter.
[Claim 4] Said parameter decision means is a projector according to claim 3 characterized by having a storage means to store the correlation data in which relation with the control parameter for satisfying two or more projection conditions and each projection conditions is shown, for every class of projector lens, and determining said control parameter based on the correlation data concerned.
[Claim 5] Said projection conditions are a projector according to claim 1 to 4 characterized by including projector distance and a projection screen size.
[Claim 6] Said lens driving means is a projector according to claim 1 to 5 characterized by having the magnifying-power adjustment device and the focal adjustment device of a projector lens.
[Claim 7] For said lens driving means, said projection conditions are a projector according to claim 1 to 6 characterized by having a perpendicular direction migration means to fluctuate the relative position of the perpendicular direction of a projector lens and the image display section, including further the information about the distance of the perpendicular direction of a plane-of-incidence-ed core and the optical axis of a projector lens.
[Claim 8] A reception means to be the projector which projects the image possible [two or more projector lenses] and displayed on the image display section on plane of projection-ed through the equipped projector lens, and to receive the input of one projection condition at least, It is based on the information about the property of the projector lens memorized by a storage means to store the information about the property of two or more of said projector lenses, and said storage means. The projector characterized by having a selection means to choose the projector lens which has a property

nearest to the lens property of fulfilling said received projection conditions as an optimal projector lens from said two or more projector lenses, and a display means to display the class of said optimal projector lens.
[Claim 9] While said projection conditions contain projector distance and a projection screen size, the property information on the projector lens stored in said storage means It is the information about projector distance required in order to obtain a predetermined projection screen size in each projector lens. Said selection means The projector according to claim 8 characterized by searching projector distance required in order to obtain said projection screen size for every projector lens, and the projector distance concerned choosing the thing nearest to said received projector distance as an optimal projector lens.
[Claim 10] Said display means is a projector according to claim 8 or 9 characterized by displaying projector distance required in order in addition to the class of said optimal projector lens to use the projector lens concerned and to obtain said received projection screen size.
[Claim 11] The lens driving means which is the projector which projects the image displayed on the image display section on plane of projection-ed through a projector lens, and drives said projector lens, A reception means to receive the actuation input of a coordinator, and the control means which controls said lens driving means based on said received actuation input, A pattern generating means to display a predetermined pattern on two or more locations of the screen of said image display section, Are based on the actuation input made by the coordinator that the image formation condition in each location of two or more of said patterns on which it was projected by said plane of incidence-ed should be adjusted. The projector characterized by having an operation means to calculate the adjusted value of the installation conditions of a projector body based on the controlled variable in said control means for every pattern, and a display means to display said calculated adjusted value.
[Claim 12] Said installation conditions are a projector according to claim 11 characterized by including the horizontal angle of inclination of a projector body, and a vertical angle of inclination.
[Claim 13] The projector according to claim 11 or 12 characterized by including three locations corresponding to at least 3 corners among four corners of a plane of incidence-ed in two or more locations where said predetermined pattern is displayed.
[Claim 14] A projector given in either of claims 1-13 characterized by having an input screen-display means to display the input screen which shows the content which should be received with said reception means, and the display screen control means which displays the content of an input of the coordinator received with said reception means on said input screen.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the technique which simplifies adjustment of the projection conditions of the projector concerned especially about the projector which projects the image formed in the image display section using a liquid crystal panel etc. through a projector lens.
[0002]
[Description of the Prior Art] In recent years, an image is formed in light valves, such as a liquid crystal panel, and the so-called light valve type of projector which projects the image concerned on a screen through a projector lens is spreading. When such a projector was installed in facilities, such as a hole, it was conventionally performed by the procedure as shown in drawing 19 .
[0003] As shown in this drawing, the installation procedure of the projector concerned can be divided greatly and can be divided into the phase (steps S501-S504) of a prior desk design, and the phase (steps S505-S510) of system setting in an installation site. First, in the phase of a desk design, the size (projection size) of the screen which should be projected by the projector in an installation site is determined (step S501), next outline design of the distance (projector distance) from the projector lens of the projector concerned to a screen, and the projection screen on a screen and the relative vertical-position relation of a projector is carried out (step S502).
[0004] Drawing 20 and drawing 21 are the side elevations and top views showing the relative-position relation between the projection screen on a screen 300, and a projector 200. In drawing 20 , the distance L1 from a screen 300 to the projector lens of a projector 200 shows projector distance, and the distance L2 of the difference of the mid gear of the perpendicular direction of a screen 300 to the projector lens horizontal line of projector 200 body shows the relative vertical distance of a projection screen and a projector.
[0005] About the above-mentioned projector distance L1 and a vertical distance L2, a coordinator makes an outline decision from the tooth space of the installation (chamber to install) of a projector etc., referring to the specification of the projector lens group currently prepared for the projectors concerned. Next, one [suitable] is chosen from two or more projector lenses currently prepared for every projector according to the result of the aforementioned outline design (step S503). Under the present circumstances, the magnifying power of a projector lens and the existence of a zoom function serve as an important decision ingredient at the time of selection.
[0006] And when the projector lens which has a zoom function is chosen, the zoom scale factor is determined and the amount of vertical-axes ZURASHI is estimated further. In order that an image may double a vertical projection location with the location of a screen, from the optical axis of a projector lens, this amount of vertical-axes ZURASHI is an amount which shifts the location of a light valve to a relative perpendicular direction, and is easily calculated from the screen called for at the above-mentioned step S502 - the projector relative vertical distance L2, and magnifying power.
[0007] When this calculated amount of axial ZURASHI exceeds the amount of maximum shaft ZURASHI indicated by the specification of the projector concerned, a base 250 is set under a projector

200 and the insufficient die length is compensated (step S504). Above, the desk design of the outline based on the specification of a projector is completed. Next, setting (installation and adjustment) of the site in the projector system based on the desk design of said outline is explained.
[0008] First, the location of a projector is determined and installed based on the result of the above-mentioned desk design (step S505). Under the present circumstances, while doubling with the projector distance computed by the desk design with a sufficient precision, it is necessary to adjust the relative location of the installation direction of projector 200 body, and a screen 300 with a sufficient precision. Here, the latter relative location means adjusting so that the installation direction of projector 200 body may be parallel horizontally to the direction of a normal of a screen 300 and it may specifically become the design include angle of the proper of a projector specification perpendicularly.
[0009] After setting up the location of said projector, the actual projection image with which the power source was supplied to the projector body, and it was projected on the screen is checked. Under the present circumstances, when reconfirming projector distance by location survey attaches importance to engine-performance reservation of adjustment image quality, it is common (step S506). When it is judged that a defect is in setting out of the location of a projector by the check of the aforementioned projection image and the location survey check of projector distance, it returns to step S505 and positioning of a projector is redone. When it is judged by the check of said projection image, and reconfirmation of projector distance that he has no problem, it moves to step S507, and when a projector lens is a zoom type, adjustment of projector lens magnifying power and the so-called zoom adjustment are performed, vertical-axes ZURASHI of a projector lens is adjusted continuously (step S508), and the focus of a projector lens is adjusted further continuously (step S509).
[0010] The aforementioned zoom adjustment, vertical-axes ZURASHI adjustment, and focal adjustment need to perform these adjustments suitably, while a coordinator checks the projection image on a screen, since it is not the adjustment which became independent thoroughly. That is, it checks with a projection screen again, tuning them finely, and if not enough, the amount of axial ZURASHI and focal adjustment will be repeated from zoom adjustment, and it will be made to converge on the optimal projection conditions, since the amount of axial ZURASHI and the amount of focal adjustments will be changed if a zoom dilation ratio is changed and it is necessary to adjust this further.
[0011] According to the image quality demand level of an activity application, the homogeneous check of the focal engine performance in a screen size, geometric distortion, and the whole screen surface is performed about the adjustment result of a projection screen after the above adjustment termination (step S510). In the phase of a check of this adjustment result, if a problem is still in a projection condition, when it returns to positioning of the projector of step S505 again, and it carries out by having repeated fine adjustment of the location of the projector after it, and readjustment of a projection lens system, consequently it is judged that there is no problem in the image quality demand level of an activity application at step S510, setting (installation and adjustment) of a projector will be completed.
[0012] By the way, in the latest projector, in order to simplify the adjustment of a projector mentioned above, there is an example which has made adjustment of a projection lens system electric. The example of a configuration of the drive system of the projector lens of such a projector is explained using drawing 22 . As shown in this drawing, the actuation system of a projector lens holds perpendicularly the focal actuator 211 which is electric and drives the focal adjustment device of a projector lens 210, the zoom actuator 212 which is electric and drives a zoom adjustment device, and a projector lens 210 movable, and it consists of vertical-axes ZURASHI actuators 214 which are electric and drive the vertical-axes ZURASHI device 213 in which vertical-axes ZURASHI is performed, and this vertical-axes ZURASHI device 213.
[0013] The control section which controls the actuation system of the aforementioned projection lens system is constituted by the remote control switch (only henceforth "remote control") 201, the remote control signal light sensing portion 202, the remote control signal decoding circuit 203, a microcomputer 205, and data memory 206. The case where focal adjustment is carried out by the projection lens system actuation system is hereafter made into an example, and the control action of a projector 200 is explained. A coordinator performs the key stroke of remote control 201, checking the focal adjustment

condition of the image projected on the screen screen. The remote control control signal according to the key stroke of a coordinator is sent with gestalten, such as an infrared signal, from remote control 201, and it is inputted into the remote control signal light sensing portion 202 of a projector body.
[0014] The dispatch signal of gestalten, such as an infrared signal, is changed into an analog electrical signal in the remote control signal light sensing portion 202. An analog electrical signal is decoded by the digital signal in the remote control signal decoding circuit 203, and is inputted into a microcomputer 205. In a microcomputer 205, the focal control signal according to the inputted remote control control information is outputted to the focal actuator 211.
[0015] The focal actuator 215 does adjustable [of the focal condition of the projection image on a screen] by driving the focal adjustment device of a projector lens 210 according to the focal control signal received from the microcomputer 205. Checking change of the focal condition on the screen which it is as a result of actuation of the above, a coordinator performs remote control actuation and, thereby, sets it as the optimal focus condition. Then, the adjustment data of an optimal focus amendment condition are kept by the data memory 206 of a non-volatile with the directions from remote control 201.
[0016] When carrying out actuation control of the zoom actuator 212 and the vertical-axes ZURASHI actuator 214, a series of actuation from remote control 201 and control of a signal are also the same as that of the case of focal adjustment.
[0017]
[Problem(s) to be Solved by the Invention] However, by doubling with the specification of projection conditions and a projector lens as mentioned above, positioning of a projector body, the magnifying power of a projector lens, the focus, and the method of performing each adjustment of axial ZURASHI in the combination of the visual inspection on a screen, and manual positioning of a projector body and the hand regulation of a projector lens needed to be optimized repeating repeatedly as mentioned above, and had a technical problem in respect of adjustment time amount, adjustment precision, and regulatory cost. Therefore, also in the phase of a desk design, projection conditions needed to be set up in a high precision (the range of a several cm error), and this had also taken time amount.
[0018] If each part must be independently adjusted at all while a coordinator checks visually although such a situation became more convenient than hand control in the place which made the projection lens system electric actuation, there is no change in the same time and effort being required for convergence to an optimum state. A commercial-scene demand in recent years is especially made into a background. Big-screen-izing of a projection screen, a raise in brightness, The demand of high-definition-izing and the long focusing of the projector distance in a specified use, utilization non-establishing permanently, etc. is increasing focusing on the large-sized high brightness projector. Such a large-sized projector Since weight is large, when anchoring sets in the severe location of installation conditions, such as head lining of a large hall, easily, it is dramatically difficult to adjust repeatedly as mentioned above.
[0019] moreover -- in said high brightness projector, the option selection of a projector lens fixed focus types and zoom type [some kinds of] is common -- becoming -- **** -- a projection lens -- things -- since projection conditions differ, it is also the factor which takes time amount further for optimization of the above-mentioned installation. This invention is made in view of an above-mentioned trouble, and it aims at offering the projector which can perform the optimal installation and the adjustment to a hole etc. easily especially.
[0020]
[Means for Solving the Problem] In order to attain the above-mentioned object, the projector concerning this invention is equipped with the lens driving means which drives a projector lens, a reception means to receive the input of at least one projection condition, a parameter decision means to determine the control parameter of a lens driving means based on said received projection conditions, and the control means that controls said lens driving means based on said determined control parameter. Since a control parameter is determined automatically and a lens driving means drives by this according to it according to the projection conditions received with the reception means, the need that a coordinator carries out troublesome adjustment manually like before becomes absolutely none, and the quick installation and

the adjustment of it are attained.
[0021] What is necessary is to receive the projector lens with which it equips, and projection conditions, and just to determine the control parameter suitable for the projector lens concerned, when exchange of two or more projector lenses is possible to a projector here. Moreover, if it has a selection means to choose the projector lens which has a property nearest to the lens property of fulfilling the projection conditions which store the information about the property of two or more projector lenses in the storage means, and were received based on that information as an optimal projector lens, and a display means to display the class of this optimal projector lens, it will become, without a coordinator wavering in selection of a projector lens.
[0022] Moreover, a reception means by which the projector concerning this invention receives the actuation input of a coordinator, The control means which controls a lens driving means based on said received actuation input, A pattern generating means to display a predetermined pattern on two or more locations of the screen of the image display section, Are based on the actuation input made by the coordinator that the image formation condition in each location of two or more of said patterns on which it was projected by said plane of incidence-ed should be adjusted. Based on the controlled variable in said control means for every pattern, it has an operation means to calculate the adjusted value of the installation conditions of a projector body, and a display means to display this adjusted value. By this A coordinator only adjusts the image formation condition of each pattern, can obtain the adjusted value of the installation conditions of a projector body, and can adjust highly precise installation conditions easily.
[0023] Moreover, this invention is equipped with an input screen-display means to display the input screen which shows the content which should be received with a reception means, and the display screen control means which displays the content of an input of the coordinator received with said reception means on said input screen, and a coordinator becomes possible [performing adjustment actuation very easily] by seeing the content of the display screen concerned.
[0024]
[Embodiment of the Invention] Hereafter, the gestalt of operation of the projector concerning this invention is explained, referring to a drawing.
(Gestalt 1 of operation)
(1) The block diagram 1 of a projector 100 is a block block diagram of the projector 100 concerning the gestalt 1 of operation of this invention.
[0025] This projector 100 mainly consists of control-system 100A, image display system 100B, and projection lens system 100C. Control-system 100A is constituted by the remote control 1 for remote operation, the remote control signal light sensing portion 2, the remote control signal decoding circuit 3, operation part 4, a microcomputer 5, the projection condition presetting memory 6, and the lens adjustment data memory 7.
[0026] This projector 100 is constituted so that two or more projector lenses may be exchangeable, and the data (projector lens correlation data) of projector distance required to project with that magnifying power and the target projection screen size are stored in the projection condition presetting memory 6 in the map format for two or more projector lenses of every concerned. Moreover, the lens adjustment data memory 7 is for holding the controlled variable at the time of adjusting projection lens system 100C (adjustment data).
[0027] If a coordinator sends directions to the body of equipment through remote control 1, it will be received by the remote control signal light sensing portion 2, and the signal from remote control 1 will be decoded in the remote control signal decoding circuit 3, and will be sent to a microcomputer 5. A microcomputer 5 controls the content of a display of each actuator of projection lens system 100C, or the display device 10 of image display system 100B while making an operation required for operation part 4 perform according to the program stored in the internal memory with reference to the content of storage of the projection condition presetting memory 6 or the lens adjustment data memory 7 based on directions of the received signal. About these detailed contents of control, it mentions later.
[0028] Image display system 100B The light source 8, a condenser lens 9, a display device 10, and this

display device 10 The video signal inputted from the OSD signal generating circuit 11 for generating the signal composition and the display device actuation circuit 16 for driving, and the pattern and input screen for adjustment, and making other images display in piles on a screen (on-screen display), the test pattern generating circuit 12, and the outside It has A/D converter 13 for reproducing, the frame rate conversion circuit 14, the number conversion circuit 15 of pixels, etc.

[0029] The electrochromatic display panel of a transparency mold is being used for the display device 10 which is a light valve with the gestalt of this operation. The circuitry for driving this display device 10 with an external video signal is well-known, and it is that example that is shown in drawing 1 . Namely, if a video signal is received from an external terminal, for example, a videocassette recorder, A/D converter 13 will change this into a digital signal, and will send it to the frame rate conversion circuit 14. In the frame rate conversion circuit 14, each synchronous frequency of a vertical synchronization and a horizontal synchronization is changed so that it may agree in the number of display pixels of a display device 10, and the video signal concerned is sent out to the number conversion circuit 15 of pixels. In the number conversion circuit 15 of pixels, after interpolating the data between the pixels of a video signal or carrying out data infanticide according to the number of pixels of a display device 10, it sends to signal composition and the display device actuation circuit 16. Signal composition and the display device actuation circuit 16 drive a display device 10 according to this video signal, and displays an image.

[0030] On the other hand, it is condensed with a condenser lens 9, incidence of the beam of light injected from the light source 8 is carried out to the image display side of a display device 10, and the transmission image is projected on a screen 30 through the projector lens 17 of projection lens system 100C. Projection lens system 100C consists of the vertical-axes ZURASHI actuator 19 for driving the drive motor 23 for vertical-axes ZURASHI in which a projector lens 17 and this projector lens 17 were formed by the vertical and horizontal lens attaching part 18 which it reaches and is held movable in the direction of an optical axis, and this lens attaching part 18, the drive motor 24 for horizontal-axis ZURASHI, the drive motor 25 for focuses, and the drive motor 26 for zoom, respectively, the horizontal-axis ZURASHI actuator 20, a focal actuator 21, and a zoom actuator 22.

[0031] Drawing 2 is a perspective view to show the configuration of the drive in the above-mentioned lens attaching part 18. The lens attaching part 18 consists of the lens maintenance block 181 with which it is equipped with a projector lens 17 exchangeable, the block maintenance frame 182 which holds this lens maintenance block 181 movable perpendicularly (Z direction), a movable carriage seat 183 which holds this maintenance frame 182 movable in the direction of an optical axis (the direction of X), and a fixed plinth 184 which holds this movable carriage seat 183 movable to horizontally (the direction of Y) it intersects perpendicularly with an optical axis further.

[0032] Two rods 1811 and 1812 are set up perpendicularly and these two rods have penetrated possible [sliding] on the top face of the lens maintenance block 181 to the rod attachment component 1821 attached to the block maintenance frame 182. The underside side of the lens maintenance block 181 also has same maintenance structure, and the lens maintenance block 181 is held by these possible [sliding of a perpendicular direction (Z direction)] with a projector lens 17. The block maintenance frame 182 is held possible [sliding of the direction of X] with the rail which is not illustrated at the movable carriage seat 183, and is held possible [sliding of the direction of Y] with the rail which similarly does not illustrate the movable carriage seat 183.

[0033] As a driving means to each direction, the drive motor 23 for vertical-axes ZURASHI, the drive motor 24 for horizontal-axis ZURASHI, and the drive motor 25 for focuses are used, and bolts 231, 241, and 251 are directly linked with the shaft of those drive motors. Bolts 231, 241, and 251 are screwed in the screwhole prepared in the object for actuation, respectively, and can be moved to the shaft orientations of the bolt concerned according to a well-known screw delivery operation.

[0034] Moreover, the drive motor 26 for zoom is held by the maintenance metallic ornaments which are not illustrated at the lens maintenance block 181, by the pinion 261 attached in the driving shaft, it has geared with the gearing 175 for zoom actuation prepared in the peripheral surface of a projector lens 17, the movable cylinder part 176 is rotated by this, and zoom actuation is performed. In addition, although

not illustrated especially, the home-position sensor which detects that the lens maintenance block 181, the block maintenance frame 182, and the movable carriage seat 183 are in each criteria location (home position) is formed, and once positioning the movement magnitude of these members in a criteria location, it is controlled by the rotation of each drive motor.

[0035] Although a stepping motor is used and he is trying to control by the gestalt of this operation with the number of driving pulses as each drive motor, a motor with a reduction gear and built-in encoder equipment is used, and it may be made to carry out feedback control by the detection pulse from encoder equipment. Although zoom actuation of a projector lens 17 is controlled similarly, in this case, the mark is given to the peripheral surface of the movable cylinder part 176 of a projector lens 17, and it supposes that it is in a criteria location the time of the photoelectrical sensor (un-illustrating) arranged in the predetermined location detecting this mark, and is controlled by the rotation of the drive motor 26 for zoom on the basis of this.

[0036] In addition, adjustment of a projector 100 displays the message and selection menu according to a progress condition of adjustment on a screen 30 by the projector 100 concerned, and can be set up now by dialogic operation so that it may mention later. Setting out by this dialogue formation indicates the menu screen by onscreen one on a screen, and has become the format which a coordinator chooses the item of a menu screen with remote control 1, and specifies. Drawing 3 is ****** which shows the configuration of the manual operation button of this remote control 1. It has the Arrow carbon button 104 for increasing and decreasing the numeric value which moves cursor on the menu button 103 for displaying the input carbon button 102 for making the switch group of remote control 1 decide the power button 101 for using projector 100 body as a power source ON, and the content of an input, and a menu screen, and a menu screen as shown in this drawing, or is inputted on an input screen etc.

(2) Install in a hole etc. the projector 100 which has a configuration beyond installation of a projector 100, and the procedure of adjustment, and explain to a detail below the procedure of adjusting projection lens system 100C, based on the flow chart of drawing 4 .

[0037] First, before attaching actually, a coordinator is determined by estimate on the basis of a projection screen size about the physical relationship of the projector distance from a screen to a projector 100, and the perpendicular direction of a screen and a projector 100 etc., referring to the sketch of an anchoring location etc. (step S101). These values are for carrying out temporary installation on the spot, and are good at estimate strictly. In addition, since it constitutes so that it may mention later with the gestalt of this operation and the adjustment in a site can make it very easy, although the projector lens with which raises above-mentioned each projection conditions to the precision of several centimeters in the phase of count on this desk in order to make time and effort of adjustment in a site in the former as easy as possible, and it equips also needed to be specified beforehand, it is not required up to there.

[0038] And according to the count result on this desk, temporary installation of the projector 100 is carried out in an installation site (step S102). The lens standard as a projector lens is attached in this phase. And when remote control 1 is operated, a power source is supplied to a projector 100 (step S103) and a menu button 103 is pushed, a microcomputer 5 reads the image data of an automatic setting screen from an internal memory, displays it on a display device 10 through the OSD signal generating circuit 11, and signal composition and a display device actuation circuit 16, and is made to project on a screen 30 (step S104).

[0039] What is necessary is just to carry out focal adjustment suitably so that the focus of a screen may suit by remote control actuation while a coordinator views the screen on a screen 30 when a projection screen is hard to see. In addition, in this phase, since the standard lens is still used, it is not necessary to care about the size of a actual projection screen. As mentioned above, the picture signal which reads the image data of predetermined input screens, such as the above-mentioned automatic setting screen, from an internal memory, or shows the result of a predetermined operation is generated, and a microcomputer 5 is only simplified hereafter, saying, "The screen of .. being displayed (on screen)", and expresses making them project on a screen 30.

[0040] Drawing 5 (a) shows an example of the above-mentioned automatic setting screen. In this

automatic setting screen 41, ON-OFF of automatic projection conditioning and selection of the projection direction are attained. It is made to move to the location which operates the Arrow carbon button 104 (drawing 3) of remote control 1, and chooses cursor 42, and by pushing the input carbon button 102, the content is decided and a microcomputer 5 stores the content of directions in the lens adjustment data memory 7.
[0041] In addition, "Front" in the projection direction and "Rear" show distinction of whether it projects from the screen 30 front, or to project from screen 30 back, and show distinction of whether "Floor" and "Ceiling" install a projector 100 in a floor, or for it to be made an upside-down and to attach in head lining, respectively. These setups determine whether a microcomputer 5 carries out vertical reversal of the image display in a display device 10, or right-and-left reversal is carried out, and it controls to be projected with the right sense on a screen.
[0042] Now, when "Yes" is chosen by the above-mentioned automatic setting screen 41 about automatic projection conditioning, it goes into (step S105:Yes) and automatic setting mode, and the projection condition input screen 43 as shown in drawing 5 (b) below is displayed. A projection screen size inputs the screen 30 with which the hole was equipped per inch here.
[0043] A rough value [in / in projector distance / the above-mentioned step S1] is inputted. A screen vertical position is the height (L4 of drawing 20) from the floor line of the soffit of a screen 30, and PJ vertical position is the height (L3 of this drawing 20) from the floor line of projector lens 17 core of a projector 100. The actual measurement in a site is inputted about L3 and L4. In addition, a numerical input is made with the Arrow carbon button 104 of remote control 1. If an arrow-head carbon button is besides pushed, a numeric value will become large, and it will become small if an arrow-down carbon button is pushed reversely. Moreover, in changing an input item, it pushes a right arrow or a left arrow carbon button.
[0044] A coordinator pushes the input carbon button 102, after the input of these numeric values is completed. Then, it considers that a microcomputer 5 is what the corresponding numerical input completed (step S107: Yes), and the next installation condition data processing is performed (step S108). This installation condition data processing is processing which finds the optimal projector distance required in order to choose the optimal projector lens for the projection conditions set up among the projector lens groups currently prepared for projectors 100 and to obtain the specified screen size concerned with this lens.
[0045] That is, a microcomputer 5 calculates the optimal lens, projector distance, and the amount of vertical-axes ZURASHI based on the presetting data of a numeric value and the projection condition presetting memory 6 inputted from the coordinator. The data (projector lens correlation data) of the map format which shows relation with projector distance required as shown in the following (table 1), in order to obtain a screen size and the screen size concerned for every class of projector lens are beforehand stored in the projection condition presetting memory 6.
[0046]
[A table 1]

投射レンズ相関データマップ

画面サイズ(型)	投射距離							
	固定焦点レンズ				ズームレンズ			
	TYPE－1 (1.2:1)	TYPE－2 (3.3:1)	TYPE－3 (5:1)	TYPE－4 (7:1)	TYPE－5 (1.5～3:1)		TYPE－6 (3～5.3:1)	
					最小	最大	最小	最大
50	1480	3815	5896	8530	1637	3176	2096	5431
70	2012	5155	7908	11312	2242	4388	3366	7603
100	2811	7175	10941	15504	3151	6206	5272	10861
120	3347	8525	12968	18305	3756	7419	6542	13033
150	4149	10551	16010	22510	4665	9237	8448	16292
180	4952	12578	19054	26718	5573	11056	10354	19550
200	5487	13930	21084	29524	6178	12268	11624	21722
250	6827	17311	26161	36541	7692	15299	14800	27153
300	8166	20693	31238	43559	9206	18329	17976	32583
350	9505	24075	36317	50579	10720	21360	21152	38014
400	10845	27458	41396	57598	12234	24391	24328	43444
450	12185	30841	46475	64619	13748	27422	27504	48875
500	13525	34223	51554	71639	15261	30452	30680	54305

[0047] A microcomputer 5 searches the projector lens correlation data concerned, in projector distance required in order to obtain the screen size inputted by the input screen of the above-mentioned step S106, is within the limits of the error (for example, 100mm) which can adjust difference with the inputted projector distance, and chooses the nearest thing. For example, when the inputted screen size is [projector distance] 30m (= 3000mm) in 450 inches, it asks for difference (the projector distance of the fixed focus lens of the 450 inches column of the screen size of (a table 1), and 30m), and that from which the difference is set to less than 100mm is searched. In (a table 1), although 30841mm of the projector distance of the projector lens of TYPE2 is the nearest, since there is a difference with the inputted projector distance no less than 841mm and it exceeds far 100mm of errors in which the above-mentioned adjustment is possible, it cannot adopt. Then, with reference to the column of a zoom lens, what has 30m within the limits of the strange good projector distance is searched next. In (a table 1), the projector lens of TYPE-6 is equivalent to this. In addition, although the value of 100mm of error range in which the above-mentioned adjustment is possible is beforehand stored in the projection condition presetting memory 6 as range in the cage implement 120 (drawing 18) of a projector 100 mentioned later which can be adjusted, a coordinator may constitute it so that it can be set as arbitration. Moreover, although 30 inputtedm of the projector distance which should be set up must still be sufficient since it carries out adjustable [of the projector distance for obtaining the target projection screen size] continuously within the limits of predetermined in the case of a zoom lens With the gestalt of this operation, it is stored in the amount table of projector lens adjustments used by projector lens regulating processing of the below-mentioned step S112 (table 2), and the value (30004mm) nearest to 30m is set up as optimal projector distance.

[0048] Next, it asks for the difference delta L of screen - PJ vertical position, i.e., the center of a screen 30, and the perpendicular direction of the optical axis of a projector lens 17. This value can be easily found as deltaL=L4+(Lv/2)-L3. However, Lv is the die length (refer to drawing 20) of the perpendicular direction of a screen. And the result of an operation obtained as mentioned above is displayed on a screen 30 as the result-of-an-operation display screen 44 as shown in drawing 6 (step S109).

[0049] After a check of this result of an operation, a coordinator is reinstalled so that projector distance may be surveyed and the displayed distance concerned may be suited, while exchanging a projector lens

for the optimal projector lens. Moreover, it checks from specification whether it is extent which it can complement with vertical-axes ZURASHI adjustment, if that is right, it is not necessary to change especially the height of a projector 100 but, and about vertical difference deltaL, when that is not right, a projector 100 is adjusted so that the difference concerned may become in tolerance about the height of an installation base.

[0050] Then, although a coordinator performs the input of Yes or No about the acknowledgment indicator of the conditioning of the result-of-an-operation display screen 44 (drawing_6), setting out of the displayed projector distance when the height of a projector 100 is changed as mentioned above inputs the projection conditions which returned to step S106 and were newly changed when [a certain] a situation was not able to be carried out, and it repeats the above-mentioned actuation.

[0051] On the other hand, when the purport currently installed as the installation condition at step S111 is checked, it moves to step S112 and projector lens regulating processing is performed. In this projector lens regulating processing, a microcomputer 5 is the processing which adjusts to the optimal image formation condition according to the screen size and the projector distance conditions of having inputted the condition of a projector lens 17 through the vertical-axes ZURASHI actuator 19, the focal actuator 21, and the zoom actuator 22, automatically.

[0052] Drawing_7 is a flow chart which shows the subroutine of this projector lens regulating processing. First, the amount of ** zoom adjustments, the amount of ** focus adjustments, and the amount of ** vertical-axes ZURASHI are acquired from the wearing projector lens by which the check was carried out [above-mentioned], projector distance, and the value of the vertical difference delta L.

[0053] Considering the case where a zoom lens is generally chosen as a projector lens 17, a required dilation ratio is first called for from the ratio of the size and the screen size of a display device 10, and the required focal distance of a projector lens 17 can be found based on the value of this dilation ratio and projector distance. If a focal distance can be found, the amount of focal adjustments will be determined that it will become the location with the general image formation equation of optics since the distance of the projector lens 17 of the direction of an optical axis and a display device 10 can be specified.

[0054] However, if it says more strictly, since the distance of a projector lens 17 and a screen 30 will be changed by focal adjustment, though a projection screen size is also minute, it changes. Therefore, it is more desirable to adjust a zoom and a focus, giving relevance mutually, with a projection screen size not changed, so that focal adjustment may be performed. Then, while the projection screen size has been eternal as mentioned above, according to the property of each projector lens, it asks for the relation between the amount of zoom adjustments for doubling a focus, and the amount of focal adjustments beforehand, and he is trying to store in the projection condition presetting memory 6 by making this into the amount table of projector lens adjustments, and to calculate the amount of zoom adjustments, and the amount of focal adjustments with the gestalt of this operation, referring to this presetting data. As an example of this amount table of projector lens adjustments, a projection screen size is 450 inches and the following (table 2) is a table showing a table in case the projector lens 17 with which it is equipped is TYPE-6.

[0055]

[A table 2]

投射レンズ調整量テーブル

投射レンズ	TYPE-6	
投射画面サイズ(インチ)	450	
投射距離(mm)	ズーム調整量(パルス)	フォーカス調整量(パルス)
27504	p_1	q_1
27604	p_2	q_2
27704	p_3	q_3
⋮	⋮	⋮
30004	p_m	q_m
30104	p_{m+1}	q_{m+1}
⋮	⋮	⋮
48704	p_{n-2}	q_{n-2}
48804	p_{n-1}	q_{n-1}
48875	p_n	q_n

[0056] being concerned (table 2) -- it sets, and the amount of zoom adjustments and the amount of focal adjustments required in order that projector distance may be minced at intervals of 100mm (however, 48804 to 48875mm of the last has fractional spacing of 71mm), may get down from the 27504 shortestmm to the 48875 longestmm and may obtain a 450 inches projection screen in the case of each projector distance are associated and stored.
[0057] The amount of zoom adjustments and the amount of focal adjustments show the amount of actuation of the corresponding drive motor with the number of driving pulses from the time of a projector lens 17 being in the location of a home position in each direction. Beforehand, by the simulation by well-known optical count or a well-known computer, these values are calculated for every class of projector lens, and projection screen size, and are stored in the amount table of projector lens adjustments in the above-mentioned projection condition presetting memory 6. In addition, such an amount table of projector lens adjustments is prepared for every projection screen size about the projector lens of each zoom mold.
[0058] With the gestalt of this operation, in the above-mentioned step S110, since it is set as the projector distance of 30004mm so that it may become the projection screen size of 450 inches with the projector lens of TYPE-6, about pm pulse and the amount of focal adjustments, the value of qm pulse can be acquired [amount / of zoom adjustments] from the table concerned. on the other hand, the magnitude of the display screen of a display device 10 should be set to K inches, then dilation ratio M=450 (inch) / K (inch) -- since come out and it is -- the difference of the above-mentioned perpendicular direction -- the amount delta L/M which **(ed) amount deltaL with the dilation ratio M --

a display device 10 -- the optical axis of a projector lens 17 -- receiving -- the above -- what is necessary is just to make it move to the direction and opposite direction which have produced difference

[0059] With the gestalt of this operation, since vertical-axes ZURASHI is performed by migration of a projector lens 17, this projector lens 17 calculates the amount of adjustments of the drive motor 23 for vertical-axes ZURASHI (the number of driving pulses) so that only the above-mentioned delta L/M may move perpendicularly. In addition, the relation between the number of driving pulses applied to the drive motor 23 for vertical-axes ZURASHI and the amount of axial ZURASHI is known easily. That is, since the number of driving pulses which needs Rota of a stepping motor to rotate one time is known, it is easily computable with the pulse number and die length of one pitch of a bolt 231.

[0060] And based on each control parameter (the number of driving pulses) of the amount of zoom adjustments by which acquisition was carried out [above-mentioned], the amount of focal adjustments, and the amount of vertical-axes ZURASHI adjustments, the drive motors 26, 25, and 23 which correspond through the zoom actuator 22, the focal actuator 21, and the vertical-axes ZURASHI actuator 19, respectively are driven (steps S202-S204), it ends regulating automatically, and a return is carried out to the flow chart of drawing 4 .

[0061] Thus, although the former had taken much time amount by controlling to make it converge on the optimal projection conditions while the coordinator viewed the screen of a screen and repeated independently zoom adjustment, focal adjustment, and vertical-axes ZURASHI adjustment repeatedly, respectively, according to the gestalt of this operation, it can adjust in an instant and large compaction of adjustment time amount can be realized.

[0062] Moreover, while a coordinator makes easy the design of the projection conditions which were performing the desk design conventionally by performing bidirectional actuation according the conditions of a projection screen size and projector distance to an onscreen display from remote control, actuation setting out of a projection lens system is also united, it carries out automatically, and setting out of a projection condition design and a projection lens system can be automated by easy alter operation. Since it is mainly realizable only by the addition of a program, these are realizable at cheap cost.

[0063] (Gestalt 2 of operation) The gestalt 1 of above-mentioned operation mainly explained the automatic control of the amount of zoom adjustments, the amount of focal adjustments, and the amount of vertical-axes ZURASHI among adjustments of the projector 100 for obtaining the target screen size. By this, the projection image of coarse-control level will be displayed on a screen 30 within the limits of an installation error. although it comes out enough by above-mentioned adjustment when used for the activity application as which the projection condition of high degree of accuracy is not required so much, for example, commercial presentations, -- the screen whole -- a rear spring supporter -- when a clear image formation condition is required (for example, when establishing permanently in a hole etc. and showing a Hi-Vision image), still highly precise adjustment is required.

[0064] With the gestalt 2 of this operation, it is in the condition that adjustment (henceforth a "coarse control") of a certain amount of projection conditions was already performed by hand control and the above-mentioned automatic control, and is related with the configuration for performing fine adjustment (henceforth "high-degree-of-accuracy adjustment") of the installation conditions of a projector 100 for the purpose of obtaining the display image level of high degree of accuracy further. In addition, in the gestalt 2 of this operation, since the whole projector 100 configuration is completely the same as drawing 1 , the explanation is omitted and the content of control in the procedure of high-degree-of-accuracy adjustment and control-system 100A is explained below.

[0065] Drawing 8 is a flow chart which shows the procedure of the high-degree-of-accuracy adjustment including the content of control of a microcomputer 5. First, when a coordinator pushes the menu button 103 of remote control 1, a microcomputer 5 reads the image data of the coarse-control check screen 45 as shown in drawing 9 (a) stored in the internal memory, and is made to display it on a screen 30 (step S301).

[0066] A coordinator judges and inputs the right or wrong of the projection condition in a coarse control, looking at this screen. In the case which is not desirable Choose "No" and it is confirmed

whether which conditions are concretely desirable by next inputting the screen location under the left upper right to the size and the screen of a screen size. When the projection condition in the coarse-control level which pushes the input carbon button 102 is not desirable, it moves to (step S302:Yes) and step S303, and the readjustment directions screen 46 as shown in drawing 9 (b) is displayed. While a coordinator views the screen of a screen based on this, the installation location of a projector 100 is adjusted (step S304). Under the present circumstances, it is convenient if it is made to display the correction direction of reinstallation on a screen 30 corresponding to the content inputted by drawing 9 (a). For example, when a screen size is small, it makes it display, "To lower a little installation location back."

[0067] A coordinator inputs whether it is the no it was satisfied with adjustment on the level of a coarse control of no with reinstallation with the screen of "reinstallation O.K.?" of drawing 9 (b), and when not satisfied, it returns to step S301 once again, the check screen of a coarse-control condition is displayed, and it rechecks [being / S305:No / (step), where / of a projection condition / is bad, and] it. [it] When the input of the satisfied purport is carried out, (step S305:Yes) and the high-degree-of-accuracy adjustment selection screen 47 as shown below at drawing 9 (c) are displayed (step S306).

[0068] In addition, it faces performing high-degree-of-accuracy adjustment, and since the above-mentioned step S301 to the step S305 is for only checking the installation condition in coarse-control level, it may be skipped. Here, when asking for the display image level of high degree of accuracy further, a coordinator is the key stroke of remote control 1, and chooses high-degree-of-accuracy mode (step S307: Yes).

[0069] Then, a microcomputer 5 generates the test pattern 150 as shown in drawing 10 by the test pattern generating circuit 12, and is displayed on a screen. At this time, the amount input screen 50 of adjustments as doubled and shown in drawing 13 (a) is displayed on the location which seldom laps with the test pattern concerned. As shown in drawing 10 , a test pattern 150 consists of patterns 151-159 for adjustment arranged in the location of a total of nine points of four corners of a rectangle field, the center of this field, and the center of each side (the point by which a projection condition should be adjusted with each patterns 151-159 for adjustment will be hereafter called a coordinating point 1, a coordinating point 2, ..., a coordinating point 9 sequentially from the upper left.).

[0070] And based on each projection condition of each of these patterns 151-159 for adjustment, high-degree-of-accuracy adjustment is performed as follows. That is, when the installation direction of the projector 100 to a screen 30 does not have right relative relation as it is based on specification, some distortion has arisen rather than the ideal condition, and a actual projection screen cannot fully double a focus to all the corners of a screen, either. Drawing 11 is drawing showing such a projection condition. In addition, distortion of the projection image after [expedient] explaining is exaggerated considerably, and this drawing shows it. Moreover, the patterns 151-159 for adjustment are also omitted, and it is expressing only as the profile.

[0071] It did not understand how many installation conditions since it is adjusted by extent which the flash condition from distortion or a screen seldom already understands in the phase of a coarse control although having turned to the upper right a little than an inclination with a projector 100 ideal in the state of projection of a test pattern 150 like drawing 11 can distinguish once, I could adjust in any direction actually, but time and effort great to this fine adjustment in the former was required.

[0072] It enables it to perform these amounts of adjustments easily through the following processes in the gestalt of this operation. Namely, a coordinator views the projection condition of these patterns 151-159 for adjustment, and performs optimum coordination for every coordinating point according to the amount input screen 50 of adjustments of drawing 13 (a) by which it is indicated by onscreen one (step S309).

[0073] Choosing a coordinating point 1 by remote control actuation on the amount input screen 50 of adjustments, and viewing the pattern 151 for adjustment on a screen 30 first, as shown in drawing 12 , the upper left corner of this pattern 151 for adjustment doubles the upper left corner of a screen 30, and a coordinator adjusts a focus, a zoom, and a vertical and horizontal location by remote control actuation so that each top-most vertices 1511 and 31 may be in agreement.

[0074] First, in the case of a projection condition [like drawing 11] whose test pattern 150 is, after making a dilation ratio small by zoom adjustment, a focus is doubled about the pattern 151 for adjustment, and it adjusts it so that the top chord and left part of the pattern 151 for adjustment concerned may next be in agreement with it of a screen 30 and a shaft may be shifted vertically and horizontally. Thus, information with which each previous amount of adjustments is related when the adjustment about the pattern 151 for adjustment is completed and a coordinator directs a datastore by actuation from remote control 1 (henceforth "the amount data of adjustments") In addition, this amount data of adjustments is stored as an amount of adjustments from the criteria location in actuation of each direction (the number of driving pulses). It is stored in the amount storing table of adjustments as shown in the following table 3 which was related with the coordinating point 1 and formed in the lens adjustment data memory 7 (step S309).
[0075]
[A table 3]
調整量格納テーブル

調整点	ズーム調整量 (パルス)	フォーカス調整量 (パルス)	垂直軸ズラシ量 (パルス)	水平軸ズラシ量 (パルス)
1	Δpz1	Δpf1	Δpv1	Δph1
2	Δpz2	Δpf2	Δpv2	Δph2
3	Δpz3	Δpf3	Δpv3	Δph3
4	Δpz4	Δpf4	Δpv4	Δph4
5	Δpz5	Δpf5	Δpv5	Δph5
6	Δpz6	Δpf6	Δpv6	Δph6
7	Δpz7	Δpf7	Δpv7	Δph7
8	Δpz8	Δpf8	Δpv8	Δph8
9	Δpz9	Δpf9	Δpv9	Δph9

[0076] After performing the above adjustment actuation about the coordinating point 2 or subsequent ones one by one and completing adjustment about all coordinating points (step S310: Yes), based on the data stored in the amount storing table of adjustments by these processings, the error (installation error) of the installation condition of the current projector 100 and an ideal installation condition is calculated (step S311). In addition, although it is desirable to make it adjust about the adjustment patterns 151, 153, 157, and 159 located in four corners until it makes it in agreement with the corner of a screen 30 as mentioned above, what is necessary is just to make only one corresponding side in agreement about the patterns 152, 154, 156, and 158 for adjustment of the center of each side, and it is good in the amount of adjustments of only a focus about the central pattern 155 for adjustment.
[0077] It is five kinds of adjusted values, projector distance, a right-and-left inclination (horizontal inclination), an order inclination (vertical inclination), a horizontal position, and a vertical position, which are calculated at step S311, and it mentions later about the detail of the content of an operation. And it is made to display on a screen 30 in step S312 with the result-of-an-operation display screen 51 as shows the above-mentioned result of an operation to drawing 13 (b).
[0078] A coordinator tunes the installation condition of the current projector 100 finely, looking at this display (step S313). This fine adjustment is completed, a coordinator views the screen of the test pattern 150 on a screen, high-degree-of-accuracy adjustment is checked, if it is satisfactory, in the above-mentioned installation position error display screen 51, "high-degree-of-accuracy adjustment continuation No" will be inputted from remote control 1, and this will end high-degree-of-accuracy adjustment.
[0079] When the need for high-degree-of-accuracy adjustment is sensed further reversely, "high-degree-of-accuracy adjustment continuation Yes" is inputted from remote control 1, and it returns to step S308, and repeats from the amount input of adjustments by the patterns 151-159 for adjustment. Next,

installation condition error data processing of step S311 in the flow chart of above-mentioned drawing 8 is explained.

[0080] Drawing 14 is a flow chart which shows the content of the installation condition error data processing concerned. First, based on the amount of zoom adjustments and the amount of focal adjustments in each coordinating point memorized by the amount storing table of adjustments of the above (table 3), the focal distance of a projector lens 17 and the distance to a projector lens 17 and the display screen of a display device 10 are found by the operation (step S401).

[0081] As mentioned above, since the amount of zoom adjustments is expressed with the number of driving pulses, thereby, the amount of actuation of the zoom device 171 by the drive motor 26 understands it. Since the amount of actuation and a focal distance concerned have relation of 1 to 1, the table or function which shows the relation is stored in the projection condition presetting memory 6 for every class of zoom lens, and a focal distance F can be easily found with a table or a function concerned.

[0082] On the other hand, since the amount of focal adjustments shows the amount of actuation of the drive motor 25 for focuses, the movement magnitude from the criteria location of the direction of an optical axis of a projector lens 17 can be known, and, thereby, the distance to a projector lens 17 and the screen of a display device 10 can be acquired. The distance from a projector lens 17 to each coordinating point can be found in a general image formation formula of these values and the optics in a combination lens. Drawing 15 is drawing for [which finds this distance] on the other hand explaining law. In addition, for convenience, it simplifies as a thing of explanation which becomes with two combination lenses, the 1st lens 171 by the side of a display device 10, and the 2nd lens 172 by the side of a screen 30, and the projector lens 17 is shown.

[0083] In this drawing, distance dz is the distance between the 1st and 2nd lens 171,172, and can acquire this value from the above-mentioned amount of zoom adjustments. That is, distance between lenses in a zoom criteria location is set to dz0, and it can be found considering the amount of adjustments as deltadz, then dz=dz0+deltadz. On the other hand, distance df is the distance from a display device 10 to the 1st lens 171, and can be easily found like [this] the above-mentioned distance between lenses by adding the movement magnitude at the time of the adjustment to the distance in a focal criteria location.

[0084] Now, each focal distance of the 1st and 2nd lens is set to f1 and f2, and the relation between F, then a well-known degree type is materialized in the focal distance of a combination lens.
1/F=(1/f1)+(1/f2)- (dz/(f1, f2)) .. ** -- again -- from the 1st and 2nd lens -- respectively -- the distance by the 1st principal point 1711 and the 2nd principal point 1721 -- SH1 and SH2 -- then SH1=(f1, dz)/(f1+f2-dz) ... ** SH2=(-f2, dz)/(f1+f2-dz) ... It becomes **.

[0085] Here, the image formation formula of S', then the following ** type is materialized in the distance which met the optical axis by S, the 2nd principal point 1721, and the image point 1722 on a screen in the distance in alignment with the optical axis of the point 1712 on a display device 10 (object point), and the 1st principal point 1711.
1/S'-1-/S=1/F ... Since it is **S=df+SH1, this is a known value. Moreover, since a focal distance F can be found by ** type, S' can be found if these are substituted for ** type.

[0086] If SH2 is deducted from the value of this S', since the distance ds from the 2nd lens 172 to the image point 1722 of a screen can be found, the distance D in alignment with the optical axis from the object point on a display device 10 to the image point on a screen 30 can be found by adding df and dz to this. in addition -- actual -- a projector lens 17 -- many -- although the combination of the two above lenses will be put further together and each type will be called for since it consists of several lens groups, the basic principle for finding distance D is as above-mentioned.

[0087] In return and step S402, operation part 4 performs the above distance calculation to drawing 14 about a coordinating point 1 - a coordinating point 9, and the distance D1-D9 from each display device 10 is found (step S402). And the amount of amendments of projector distance is first calculated with the value of such distance D1-D9. The average to a central distance D5 or each central distance D1-D9 with a coordinating point and a difference with the projector distance by which current setting out is carried out are searched for as an error (step S403).

[0088] Next, the horizontal amount of inclination amendments is obtained from the difference of the distance of some things among distance D1-D9 (step S404). Drawing 16 is a mimetic diagram to show the relative relation to the horizontal direction of a screen 30 and a display device 10. In addition, in order to give explanation easy, it shall be arranged so that the optical axis of a projector lens 17 and the screen of a display device 10 may cross at right angles, and coordinating points 1, 3, 7, and 9 shall correspond to each top-most vertices of a screen 30 here, respectively.
[0089] Here, supposing the distance D1 from a display device 10 to a coordinating point 1 (upper left corner) and the distance D3 by the coordinating point 3 (upper right corner) come to show drawing 16 , the horizontal relative inclination theta 1 of a screen 30 and a display device 10, i.e., a horizontal amendment angle, can be easily found by criteria, then the degree type in a coordinating point 1. Sintheta1= (D3-D1)/Lh -- here, Lh is a horizontal distance of a screen 30 (refer to drawing 21), for every size of the, it is a known value and the value of Lh corresponding to the size concerned is beforehand stored in the projection condition presetting memory 6. Since 450 inches is already inputted with the gestalt of this operation, the screen size is searched and the value of Lh is acquired.
[0090] Although the above theta 1 serves as horizontal angles of lead, since the inclination of the built-in screen 30 cannot be changed, of course, the horizontal include angle of a projector 100 will be corrected by the include angle. In addition, to say nothing of the amendment direction of an inclination changing with positive/negative of (D3-D1), when displaying theta 1 the twice which leans a projector 100 to the left sense by forward and leaning a projector 100 rightward, it distinguishes so that theta 1 may be displayed by negative, and is displayed on the installation position error display screen 51.
[0091] Under the present circumstances, in quest of amendment angle theta1' centering on a coordinating point 1, a horizontal amendment angle, then precision improve the average of theta 1 and theta1' also from a coordinating point 1 and a coordinating point 2 (center of a top chord). Then, the amendment angle theta 2 of the perpendicular direction centering on a coordinating point 1 is searched for like an above-mentioned horizontal amendment angle from relation with a coordinating point 7 (lower left corner) (step S405).
[0092] Namely, Sintheta2= (D7-D1)/Lv (however, Lv the die length of a screen perpendicular direction.) It asks by refer to drawing 20 . Thus, after searching for the amendment angle of a horizontal direction and a perpendicular direction, the amount of amendments of the location of horizontal and a perpendicular direction is computed (steps S406 and S407). As shown in drawing 17 , projection image 150" of a test pattern 150 has the shape of a screen 30 and isomorphism, and after correcting the installation include angle of a horizontal direction and a perpendicular direction, after the gap has arisen to the perpendicular direction and the horizontal direction, it should be projected. What is necessary is just to make the parallel displacement only of delta x then, carry out to vertical deltay and a horizontal direction so that top-most-vertices 1511' of the pattern 151 for adjustment and the top-most vertices 31 of a screen 30 may be in agreement.
[0093] This amount of deltax and delta y can be calculated as follows. First, since predetermined zoom adjustment (dilation ratio), focal adjustment, horizontal-axis ZURASHI, and vertical-axes ZURASHI were performed on the top-most vertices 1511 of the pattern 151 for adjustment in projection screen 150' of the test pattern 150 of a basis and it was made in agreement with the top-most vertices 31 of a screen 30, based on each above-mentioned amount of adjustments stored, it can count backward and ask for the top-most vertices 1511 of the first pattern 151 for adjustment from the location of these top-most vertices 31.
[0094] Thus, since present top-most-vertices 1511' was obtained by carrying out include-angle adjustment to the obtained top-most vertices 1511 to a location, it can ask for the location of top-most-vertices 1511' from the positional information of top-most vertices 1511, the amounts theta1 and theta2 of include-angle adjustments, and the corrected projector distance. Since these count progress may be easily drawn by the information of the usual geometry, detailed explanation here is omitted.
[0095] The amounts deltax and delta y of gaps of the level and the perpendicular direction of top-most-vertices 1511' of the pattern 151 for adjustment after the angle correction called for as mentioned above and the top-most vertices 31 of a screen 30 are displayed on the result-of-an-operation display screen 51

of drawing 13 (b) as an amount of amendments of a horizontal position and a vertical position as they are. In addition, although the pattern image in nine coordinating points was adjusted independently and the five amounts of amendments, projector distance, a right-and-left inclination, an order inclination, a horizontal position, and a vertical position, were simultaneously computed from the amount of adjustments in the gestalt 2 of this operation Since viewing can also perform adjustment of a horizontal and a vertical position, first Projector distance, a right-and-left inclination, Calculate only the amount of amendments of an order inclination, display this, and it is made to reinstall by the coordinator. Then, it is possible to drive the drive motor 23 for vertical-axes ZURASHI and the zoom actuator 24 through the vertical-axes ZURASHI actuator 19 and the horizontal-axis ZURASHI actuator 20 with remote control 1, and to make it also make the corner of the pattern 151 for adjustment in agreement with the corner of a screen 30. In addition, even when each amount of adjustments in these high-degree-of-accuracy adjustments was stored in the projection condition presetting memory 6 and adjustment is out of order in the future, based on the stored data concerned, it can readjust easily, and is convenient.

[0096] According to the gestalt of this operation, highly precise adjustment is realizable as mentioned above only by adjusting independently, viewing the projection condition of the pattern in each coordinating point. Conventionally, the big part of the service manday of a projector can be closed and simplification large about the desk design of the projection installation conditions of having required the skillful technique, installation of a projector, and high-degree-of-accuracy adjustment of a projection lens system, and automation can be attained now.

(Modification) In addition, to say nothing of not being limited to the gestalt of the above-mentioned implementation, this invention can consider the following modifications.

[0097] ** You may constitute from a gestalt 1 of the above-mentioned implementation although the projector lens was inputted from displaying the optimal projector lens and checking this by inputting projection conditions, in addition so that the class of projector lens can be inputted from remote control 1 etc.

** In the gestalt of the above-mentioned implementation, although the case where it was equipped with a zoom lens was explained, a fixed focus mold lens can be considered the same way. However, since zoom adjustment cannot be performed in this case, it cannot be overemphasized that the degree of freedom of adjustment decreases.

[0098] ** It is equipped with one kind of projector lens fixed, and, of course, application of this invention is possible also about the projector which cannot perform lens exchange. In this case, the correlation data only about the projector lens concerned are stored in the projection condition presetting memory 6.

** Although the patterns 151-159 for adjustment were displayed on nine places and the installation condition error amount was calculated with the gestalt 2 of the above-mentioned implementation based on the adjustment data of each pattern in order to ensure high-degree-of-accuracy adjustment While a plane inclination is specified by three points, since it can ask by adjustment of one of one corners, if the amount of amendments of level and a perpendicular direction can display the pattern for adjustment on the location applicable to at least three corners of a screen 30, the high-degree-of-accuracy adjustment of it will be attained.

[0099] ** With the gestalt of the above-mentioned implementation, since [a coordinator] the various input screens were indicated by onscreen one and tuning is done by dialogic operation, even if it is not an expert, there is a merit that installation and adjustment can be performed easily. Only irrespective of a screen, the display of such an input screen prepares the liquid crystal display section in a projector body or remote control, and may be made to give the same indication as this.

[0100] ** In addition, in order to reinstall a projector 100 as the result of an operation of the installation condition error in high-degree-of-accuracy adjustment of the gestalt 2 of operation, the cage implement 120 as shown in drawing 18 may be formed. As for this cage implement 120, the 2nd pedestal 122 is attached in the direction of an optical axis possible [sliding] through the slot 1221 and the bolt 1222 to the 1st pedestal 121. Moreover, the maintenance metallic ornaments 123 are attached in a longitudinal direction pivotable centering on a bolt 1231, and projector 100 body is further attached in the 2nd

pedestal 122 pivotable through a bolt 1232 at a cross direction to these maintenance metallic ornaments 123.
[0101] the screw which has the large-sized tongue 1211 is screwed in four corners of the rear face of the 1st pedestal 121 by the screw base 1212, and height is good by the bell-and-spigot condition of this screw -- it is strange and has come. And the amount of inclinations before and behind a projector 100 can be adjusted by doubling an arrow head M2 with the scale 1233 formed in the side face of projector 100 body, and the inclination of right and left of a projector 100 can be exactly adjusted by doubling an arrow head M1 with the scale 1223 formed in the 2nd pedestal 122. Furthermore, the scale 1213 formed in the 1st pedestal 121 can adjust now migration of the direction of an optical axis to accuracy.
[0102] ** With the gestalt of the above-mentioned implementation, although the liquid crystal panel of a transparency mold was shown as an example as a display device 10, since the invention in this application is in easy-ization of adjustment of projection conditions, if amplification projection can be carried out using a projector lens, the class of display device will not be limited. For example, the liquid crystal panel of a reflective mold is sufficient outside a transparency mold, and the minute mirror of a large number arranged in the shape of a matrix is driven separately, and it does not matter even if it is DMD (digital micro mirror device) which carries out image display by changing the reflective direction. Furthermore, it is applicable also to setting out of the projection conditions in the conventional film projector.
[0103]
[Effect of the Invention] According to this invention, it has the lens driving means which drives a projector lens, a reception means to receive the input of at least one projection condition, a parameter decision means to determine the control parameter of a lens driving means based on said received projection conditions, and the control means that controls said lens driving means based on said determined control parameter as mentioned above. Since a control parameter is determined automatically and a lens driving means drives by this according to it according to the projection conditions received with the reception means, the need that a coordinator carries out troublesome adjustment manually like before becomes absolutely none, and the quick installation and the adjustment of a projector of it are attained only by easy alter operation.
[0104] Moreover, if it has a selection means to choose the projector lens which has a property nearest to the lens property of fulfilling the projection conditions which store the information about the property of two or more projector lenses in the storage means, and were received based on that information as an optimal projector lens, and a display means to display the class of this optimal projector lens, it will become, without a coordinator wavering in selection of a projector lens.
[0105] Furthermore, a reception means to receive the actuation input of a coordinator and the control means which controls a lens driving means based on said received actuation input, A pattern generating means to display a predetermined pattern on two or more locations of the screen of the image display section, Are based on the actuation input made by the coordinator that the image formation condition in each location of two or more of said patterns on which it was projected by said plane of incidence-ed should be adjusted. Based on the controlled variable in said control means for every pattern, it has an operation means to calculate the adjusted value of the installation conditions of a projector body, and a display means to display this adjusted value. By this Since the adjusted value of the installation conditions of a projector body can be obtained only by a coordinator adjusting the image formation condition of each pattern Highly precise installation conditions can be adjusted easily, and while an unskilled serviceman can also secure final-adjustment level to high degree of accuracy in easy and a short time, the drastic cutback of installation cost can also be aimed at.

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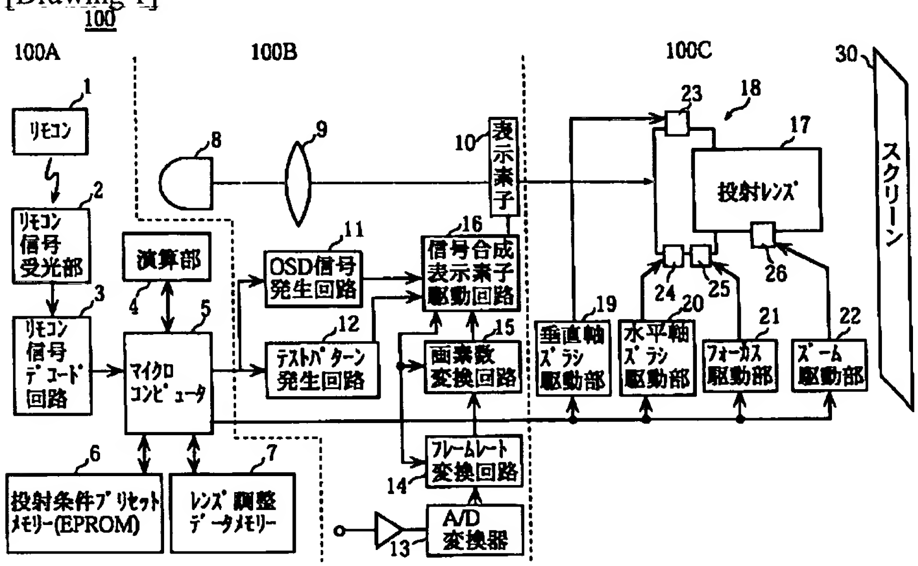
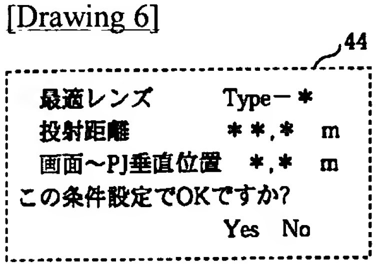
DRAWINGS

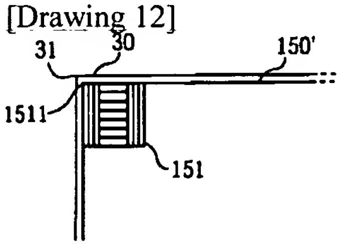
[Drawing 1]



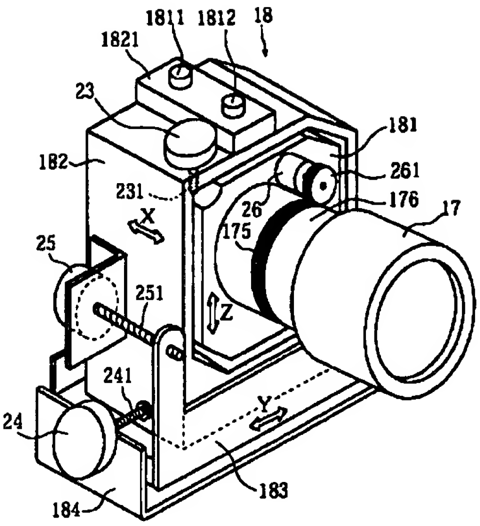
[Drawing 6]



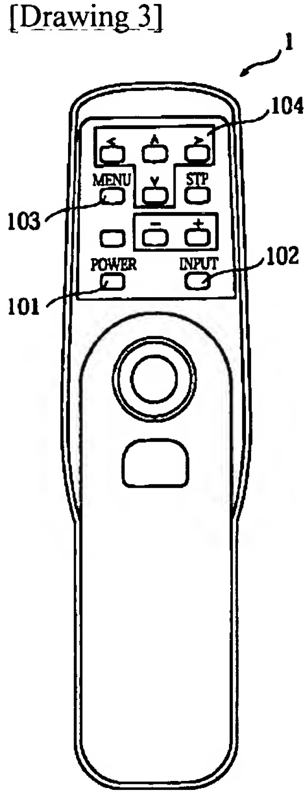
[Drawing 12]



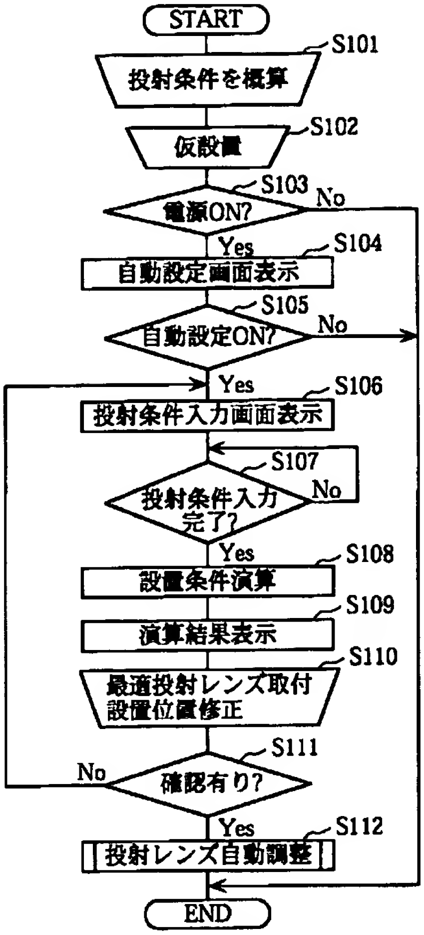
[Drawing 2]



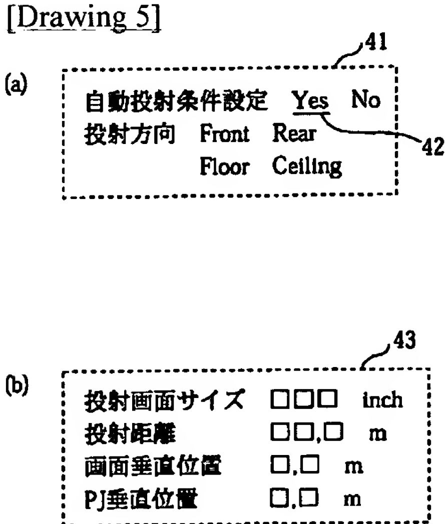
[Drawing 3]



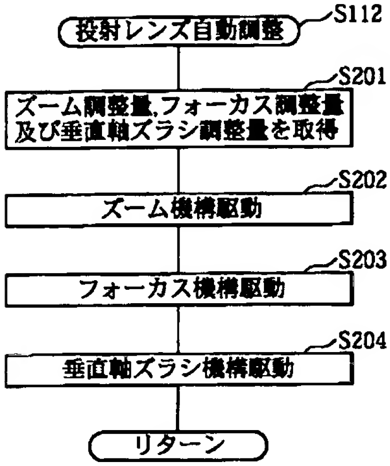
[Drawing 4]



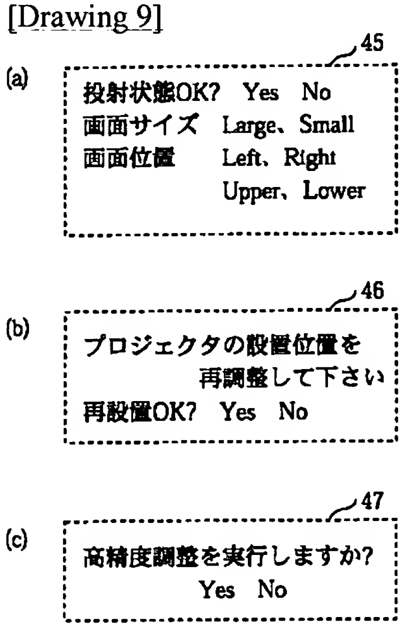
[Drawing 5]



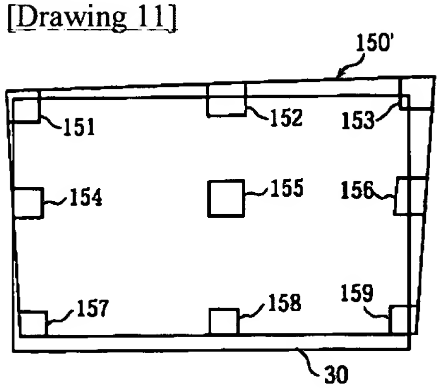
[Drawing 7]



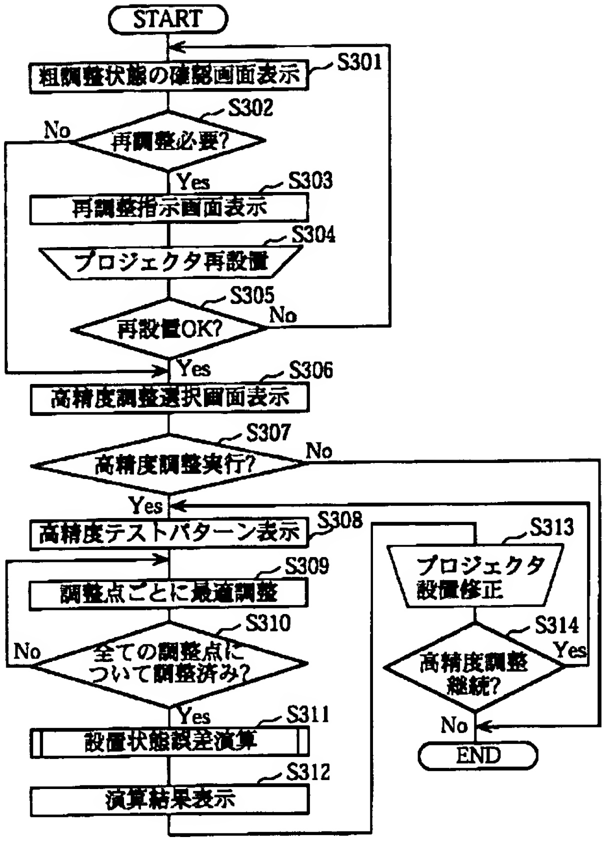
[Drawing 9]



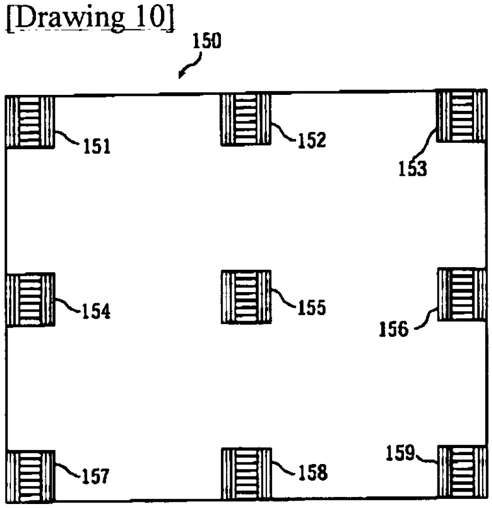
[Drawing 11]



[Drawing 8]

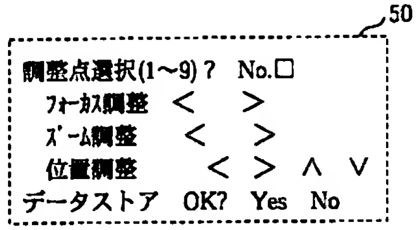


[Drawing 10]

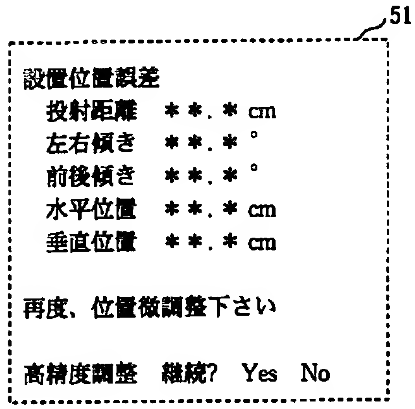


[Drawing 13]

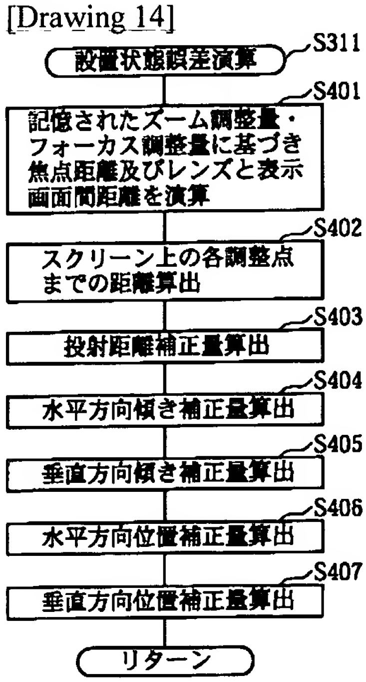
(a)



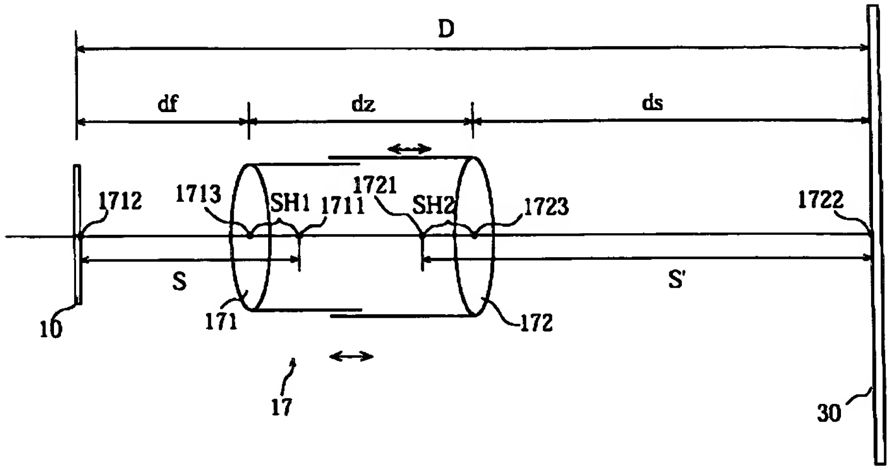
(b)



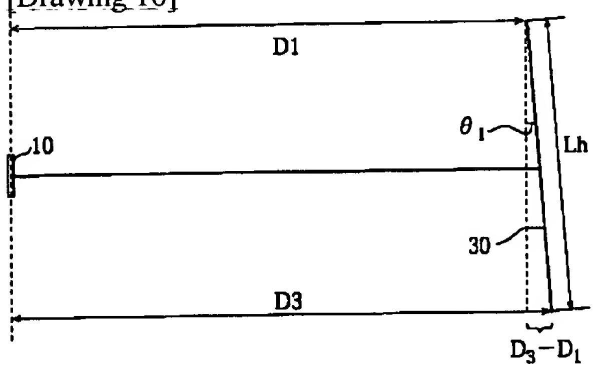
[Drawing 14]



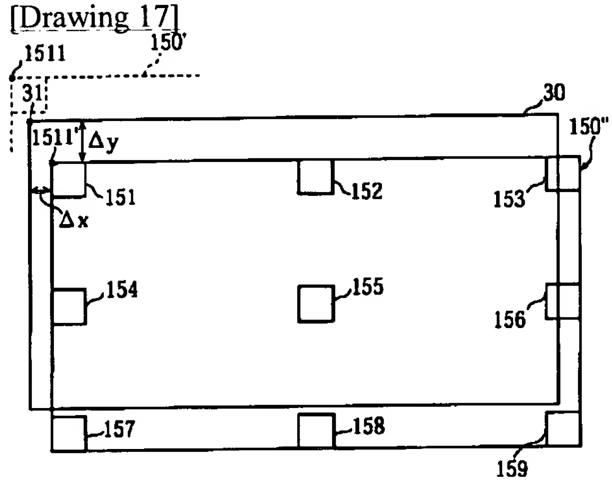
[Drawing 15]



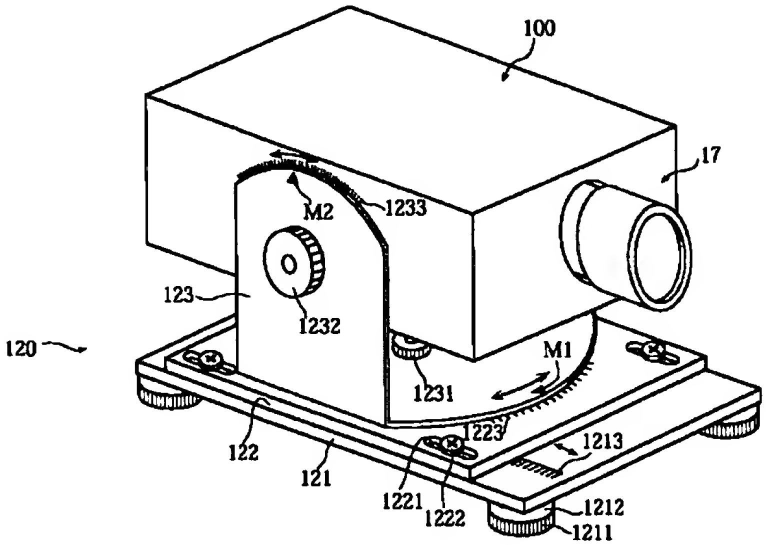
[Drawing 16]



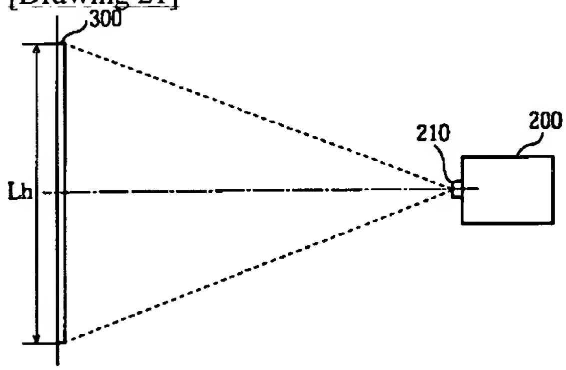
[Drawing 17]



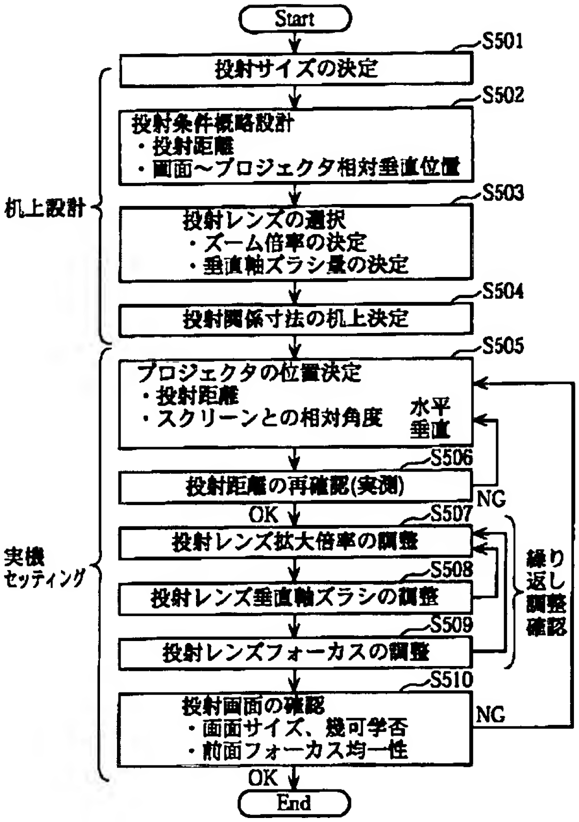
[Drawing 18]



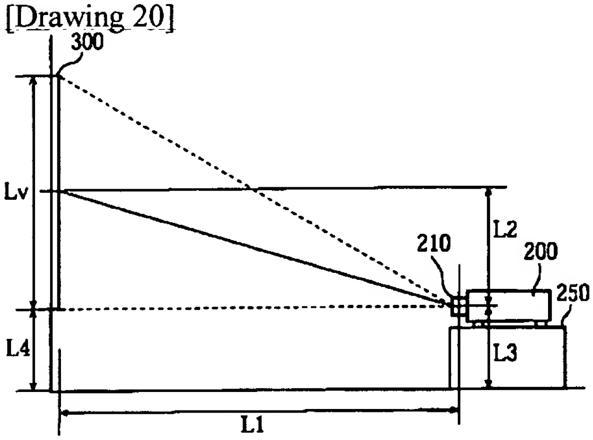
[Drawing 21]



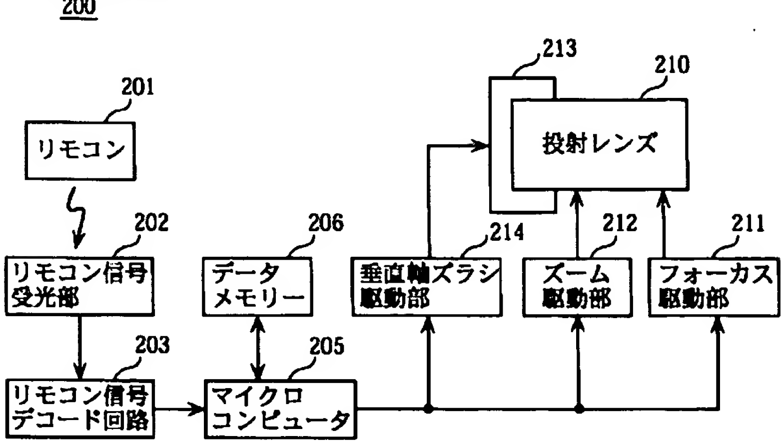
[Drawing 19]



[Drawing 20]



[Drawing 22]



[Translation done.]

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2000-081601
(43)Date of publication of application : 21.03.2000

(51)Int.Cl. G02F 1/13
G02F 1/1335
G03B 21/00
G09F 9/00

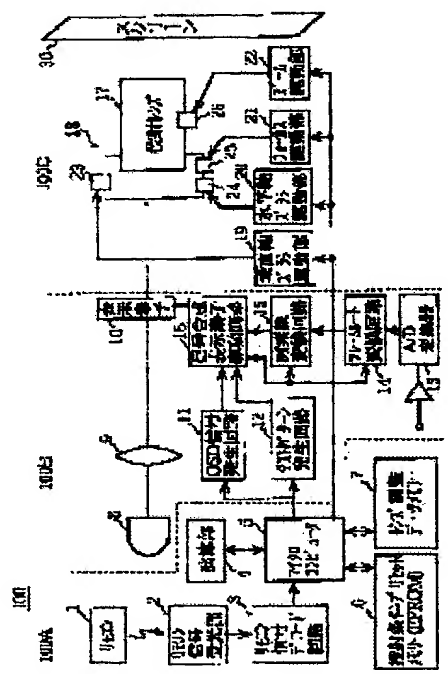
(21)Application number : 11-180900
(22)Date of filing : 25.06.1999

(71)Applicant : MATSUSHITA ELECTRIC IND CO LTD
(72)Inventor : KAWASHIMA MASAHIRO
GYOTEN TAKAAKI

(30)Priority
Priority number : 10180129 Priority date : 26.06.1998 Priority country : JP

(54) PROJECTOR

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a projector which is easily installed and adjusted.
SOLUTION: A microcomputer 5 refers to correlation data showing correlation between the kind of a projection lens, a projection screen size and an optimum projection distance stored in a projection condition preset memory 6 when a projection condition is inputted to the microcomputer 5 through a remote controller 1 so that an optimum projection lens satisfying the projection condition inputted and a projection distance at that time are displayed on a screen 30. A regulator attaches the optimum lens. and sets the position of the projector 100 at the optimum projection distance. The microcomputer 5 calculates the zooming driving quantity and the focusing quantity of the projection lens by the correction data so as to satisfy the projection screen size, so that the projection lens 17 is automatically driven through a focusing driving part 21 and a zooming driving part 22.



LEGAL STATUS

[Date of request for examination] 20.01.2003
[Date of sending the examiner's decision of rejection]
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]
[Date of final disposal for application]
[Patent number]
[Date of registration]
[Number of appeal against examiner's decision of rejection]
[Date of requesting appeal against examiner's decision of rejection]

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2022-81801

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CLAIMS

[Claim(s)]
[Claim 1] The projector characterized by to have the lens driving means which is the projector which projects the image displayed on the image-display section on a plane of incidence-ed through a projector lens, and drives said projector lens, a reception means receive the input of at least one projection condition, a parameter decision means determine the control parameter of a lens driving means based on said received projection conditions, and the control means that control said lens driving means based on said determined control parameter.
[Claim 2] Said parameter decision means is a projector according to claim 1 characterized by having a storage means to store the correlation data in which relation with the control parameter for satisfying two or more projection conditions and each projection conditions is shown, and determining said control parameter based on the correlation data concerned.
[Claim 3] The lens driving means which is the projector which projects the image possible [two or more kinds of projector lenses] and displayed on the image display section on a plane of incidence-ed through the equipped projector lens, and drives said projector lens with which it was equipped, At least one projection condition and a reception means to receive each input of the class of projector lens with which it equips, The projector characterized by having a parameter decision means to determine the control parameter of a lens driving means based on said received projection conditions and class of projector lens, and the control means which controls said lens driving means based on said determined control parameter.
[Claim 4] Said parameter decision means is a projector according to claim 3 characterized by having a storage means to store the correlation data in which relation with the control parameter for satisfying two or more projection conditions and each projection conditions is shown, for every class of projector lens, and determining said control parameter based on the correlation data concerned.
[Claim 5] Said projection conditions are a projector according to claim 1 to 4 characterized by including projector distance and a projection screen size.
[Claim 6] Said lens driving means is a projector according to claim 1 to 5 characterized by having the magnifying-power adjustment device and the focal adjustment device of a projector lens.
[Claim 7] For said lens driving means, said projection conditions are a projector according to claim 1 to 6 characterized by having a perpendicular direction migration means to fluctuate the relative position of the perpendicular direction of a projector lens and the image display section, including further the information about the distance of the perpendicular direction of a plane-of-incidence-ed core and the optical axis of a projector lens.
[Claim 8] A reception means to be the projector which projects the image possible [two or more projector lenses] and displayed on the image display section on plane of projection-ed through the equipped projector lens, and to receive the input of one projection condition at least, It is based on the information about the property of the projector lens memorized by a storage means to store the information about the property of two or more of said projector lenses, and said storage means. The projector characterized by having a selection means to choose the projector lens which has a property nearest to the lens property of fulfilling said received projection conditions as an optimal projector lens from said two or more projector lenses, and a display means to display the class of said optimal projector lens.
[Claim 9] While said projection conditions contain projector distance and a projection screen size, the property information on the projector lens stored in said storage means It is the information about projector distance required in order to obtain a predetermined projection screen size in each projector lens. Said selection means The projector according to claim 8 characterized by searching projector distance required in order to obtain said projection screen size for every projector lens, and the projector distance concerned choosing the thing nearest to said received projector distance as an optimal projector lens.
[Claim 10] Said display means is a projector according to claim 8 or 9 characterized by displaying projector distance required in order in addition to the class of said optimal projector lens to use the projector lens concerned and to obtain said received projection screen size.
[Claim 11] The lens driving means which is the projector which projects the image displayed on the image display section on plane of projection-ed through a projector lens, and drives said projector lens, A reception means to receive the actuation input of a coordinator, and the control means which controls said lens driving means based on said received actuation input, A pattern generating means to display a predetermined pattern on two or more locations of the screen of said image display section, Are based on the actuation input made by the coordinator that the image formation condition in each location of two or more of said patterns on which it was projected by said

plane of incidence-ed should be adjusted. The projector characterized by having an operation means to calculate the adjusted value of the installation conditions of a projector body based on the controlled variable in said control means for every pattern, and a display means to display said calculated adjusted value.
[Claim 12] Said installation conditions are a projector according to claim 11 characterized by including the horizontal angle of inclination of a projector body, and a vertical angle of inclination.
[Claim 13] The projector according to claim 11 or 12 characterized by including three locations corresponding to at least 3 corners among four corners of a plane of incidence-ed in two or more locations where said predetermined pattern is displayed.
[Claim 14] A projector given in either of claims 1-13 characterized by having an input screen-display means to display the input screen which shows the contents which should be received with said reception means, and the display screen control means which displays the contents of an input of the coordinator received with said reception means on said input screen.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the technique which simplifies adjustment of the projection conditions of the projector concerned especially about the projector which projects the image formed in the image display section using a liquid crystal panel etc. through a projector lens.
[0002]
[Description of the Prior Art] In recent years, an image is formed in light valves, such as a liquid crystal panel, and the so-called light valve type of projector which projects the image concerned on a screen through a projector lens is spreading. When such a projector was installed in facilities, such as a hole, it was conventionally performed by the procedure as shown in drawing 19 .
[0003] As shown in this drawing, the installation procedure of the projector concerned can be divided greatly and can be divided into the phase (steps S501-S504) of a prior desk design, and the phase (steps S505-S510) of system setting in an installation site. First, in the phase of a desk design, the size (projection size) of the screen which should be projected by the projector in an installation site is determined (step S501), next outline design of the distance (projector distance) from the projector lens of the projector concerned to a screen, and the projection screen on a screen and the relative vertical-position relation of a projector is carried out (step S502).
[0004] Drawing 20 and drawing 21 are the side elevations and top views showing the relative-position relation between the projection screen on a screen 300, and a projector 200. In drawing 20 , the distance L1 from a screen 300 to the projector lens of a projector 200 shows projector distance, and the distance L2 of the difference of the mid gear of the perpendicular direction of a screen 300 to the projector lens horizontal line of projector 200 body shows the relative vertical distance of a projection screen and a projector.
[0005] About the above-mentioned projector distance L1 and a vertical distance L2, a coordinator makes an outline decision from the tooth space of the installation (room to install) of a projector etc., referring to the specification of the projector lens group currently prepared for the projectors concerned. Next, one [suitable] is chosen from two or more projector lenses currently prepared for every projector according to the result of the aforementioned outline design (step S503). Under the present circumstances, the magnifying power of a projector lens and the existence of a zoom function serve as an important decision ingredient at the time of selection.
[0006] And when the projector lens which has a zoom function is chosen, the zoom scale factor is determined and the amount of vertical-axes ZURASHI is estimated further. In order that an image may double a vertical projection location with the location of a screen, from the optical axis of a projector lens, this amount of vertical-axes ZURASHI is an amount which shifts the location of a light valve to a relative perpendicular direction, and is easily calculated from the screen called for at the above-mentioned step S502 - the projector relative vertical distance L2, and magnifying power.
[0007] When this calculated amount of axial ZURASHI exceeds the amount of maximum shaft ZURASHI indicated by the specification of the projector concerned, a base 250 is set under a projector 200 and insufficient die length is compensated (step S504). Above, the desk design of the outline based on the specification of a projector is completed. Next, setting (installation and adjustment) of the site in the projector system based on the desk design of said outline is explained.
[0008] First, the location of a projector is determined and installed based on the result of the above-mentioned desk design (step S505). Under the present circumstances, while doubling with the projector distance computed by the desk design with a sufficient precision, it is necessary to adjust the relative location of the installation direction of projector 200 body, and a screen 300 with a sufficient precision. Here, the latter relative location means adjusting so that the installation direction of projector 200 body may become parallel horizontally to the direction of a normal of a screen 300 and it may specifically become the design include angle of the proper of a projector specification perpendicularly.
[0009] After setting up the location of said projector, the actual projection image with which the power source was supplied to the projector body, and it was projected on the screen is checked. Under the present circumstances, when reconfirming projector distance by observation attaches importance to engine-performance reservation of adjustment image quality, it is common (step S506). When it is judged that a defect is in a setup of the location of a projector by the check of the aforementioned projection image and the observation check of projector distance, it returns to step S505 and the location of a projector is redone. When it is judged by the check of said projection image, and reconfirmation of projector distance that he has no problem, it moves to step S507, and when a projector

lens is a zoom type, adjustment of projector lens magnifying power and the so-called zoom adjustment are performed, vertical-axes ZURASHI of a projector lens is adjusted continuously (step S508), and the focus of a projector lens is adjusted further continuously (step S509).
[0010] The aforementioned zoom adjustment, vertical-axes ZURASHI adjustment, and focal adjustment need to perform these adjustments suitably, while a coordinator checks the projection image on a screen, since it is not the adjustment which became independent completely. That is, it checks with a projection screen again, tuning them finely, and if not enough, the amount of axial ZURASHI and focal adjustment will be repeated from zoom adjustment, and it will be made to converge on the optimal projection conditions, since the amount of axial ZURASHI and the amount of focal adjustments will be changed if a zoom dilation ratio is changed and it is necessary to adjust this further.
[0011] According to the image quality demand level of a use application, the homogeneous check of the focal engine performance in a screen size, geometrical distortion, and the whole screen surface is performed about the adjustment result of a projection screen after the above adjustment termination (step S510). In the phase of a check of this adjustment result, if a problem is still in a projection condition, when it returns to the location of the projector of step S505 again, and it carries out by having repeated fine tuning of the location of the projector after it, and readjustment of a projection lens system, consequently it is judged that there is no problem in the image quality demand level of a use application at step S510, setting (installation and adjustment) of a projector will be completed.
[0012] By the way, in the latest projector, in order to simplify the adjustment of a projector mentioned above, there is an example which has made adjustment of a projection lens system electric. The example of a configuration of the drive system of the projector lens of such a projector is explained using drawing 22 . As shown in this drawing, the drive system of a projector lens holds perpendicularly the focal mechanical component 211 which is electric and drives the focal adjustment device of a projector lens 210, the zoom mechanical component 212 which is electric and drives a zoom adjustment device, and a projector lens 210 movable, and it consists of vertical-axes ZURASHI mechanical components 214 which are electric and drive the vertical-axes ZURASHI device 213 in which vertical-axes ZURASHI is performed, and this vertical-axes ZURASHI device 213.
[0013] The control section which controls the drive system of the aforementioned projection lens system is constituted by the remote control switch (only henceforth "remote control") 201, the remote control signal light sensing portion 202, the remote control signal decoding circuit 203, a microcomputer 205, and data memory 206. The case where focal adjustment is carried out by the projection lens system drive system is hereafter made into an example, and the control action of a projector 200 is explained. A coordinator performs the key stroke of remote control 201, checking the focal adjustment condition of the image projected on the screen screen. The remote control control signal according to the key stroke of a coordinator is sent with gestalten, such as an infrared signal, from remote control 201, and it is inputted into the remote control signal light sensing portion 202 of a projector body.
[0014] The dispatch signal of gestalten, such as an infrared signal, is changed into an analog electrical signal in the remote control signal light sensing portion 202. An analog electrical signal is decoded by the digital signal in the remote control signal decoding circuit 203, and is inputted into a microcomputer 205. In a microcomputer 205, the focal control signal according to the inputted remote control control information is outputted to the focal mechanical component 211.
[0015] The focal mechanical component 215 carries out adjustable [of the focal condition of the projection image on a screen] by driving the focal adjustment device of a projector lens 210 according to the focal control signal received from the microcomputer 205. Checking change of the focal condition on the screen which it is as a result of actuation of the above, a coordinator performs remote control actuation and, thereby, sets it as the optimal focus condition. Then, the adjustment data of an optimal focus amendment condition are kept by the data memory 206 of a non-volatile with the directions from remote control 201.
[0016] When carrying out drive control of the zoom mechanical component 212 and the vertical-axes ZURASHI mechanical component 214, a series of actuation from remote control 201 and control of a signal are also the same as that of the case of focal adjustment.
[0017]
[Problem(s) to be Solved by the Invention] However, by doubling with the specification of projection conditions and a projector lens as mentioned above, justification of a projector body, the magnifying power of a projector lens, the focus, and the method of performing each adjustment of axial ZURASHI in the combination of the visual inspection on a screen, and manual justification of a projector body and the hand regulation of a projector lens needed to be optimized repeating repeatedly as mentioned above, and had a technical problem in respect of adjustment time amount, adjustment precision, and regulatory cost. Therefore, also in the phase of a desk design, projection conditions needed to be set up in a high precision (the range of a several cm error), and this had also taken time amount.
[0018] If each part must be independently adjusted at all while a coordinator checks visually although such a situation became more convenient than hand control in the place which made the projection lens system the electric drive, there is no change in the same time and effort being required for convergence to an optimum state. A commercial-scene demand in recent years is especially made into a background. Big-screen-izing of a projection screen, a raise in brightness, The demand of high-definition-izing and the long focusing of the projector distance in a specified use, use non-establishing permanently, etc. is increasing focusing on the large-sized high brightness

projector. Such a large-sized projector Since weight is large, when anchoring sets in the severe location of installation conditions, such as head lining of a large hall, easily, it is very difficult to adjust repeatedly as mentioned above.
[0019] moreover — in said high brightness projector, the option selection of a projector lens fixed focus types and zoom type [some kinds of] is common — becoming — **** — a projection lens — things — since projection conditions differ, it is also the factor which takes time amount further for optimization of the above-mentioned installation. This invention is made in view of an above-mentioned trouble, and it aims at offering the projector which can perform the optimal installation and the adjustment to a hole etc. easily especially.
[0020]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, the projector concerning this invention is equipped with the lens driving means which drives a projector lens, a reception means to receive the input of at least one projection condition, a parameter decision means to determine the control parameter of a lens driving means based on said received projection conditions, and the control means that controls said lens driving means based on said determined control parameter. Since a control parameter is determined automatically and a lens driving means drives by this according to it according to the projection conditions received with the reception means, the need that a coordinator carries out troublesome adjustment manually like before becomes absolutely none, and the quick installation and the adjustment of it are attained.
[0021] What is necessary is to receive the projector lens with which it equips, and projection conditions, and just to determine the control parameter suitable for the projector lens concerned, when exchange of two or more projector lenses is possible to a projector here. Moreover, if it has a selection means to choose the projector lens which has a property nearest to the lens property of fulfilling the projection conditions which store the information about the property of two or more projector lenses in the storage means, and were received based on that information as an optimal projector lens, and a display means to display the class of this optimal projector lens, it will become, without a coordinator wavering in selection of a projector lens.
[0022] Moreover, a reception means by which the projector concerning this invention receives the actuation input of a coordinator, The control means which controls a lens driving means based on said received actuation input, A pattern generating means to display a predetermined pattern on two or more locations of the screen of the image display section, Are based on the actuation input made by the coordinator that the image formation condition in each location of two or more of said patterns on which it was projected by said plane of incidence-ed should be adjusted. Based on the controlled variable in said control means for every pattern, it has an operation means to calculate the adjusted value of the installation conditions of a projector body, and a display means to display this adjusted value. By this A coordinator only adjusts the image formation condition of each pattern, can obtain the adjusted value of the installation conditions of a projector body, and can adjust highly precise installation conditions easily.
[0023] Moreover, this invention is equipped with an input screen-display means to display the input screen which shows the contents which should be received with a reception means, and the display screen control means which displays the contents of an input of the coordinator received with said reception means on said input screen, and a coordinator becomes possible [performing adjustment actuation very easily] by seeing the contents of the display screen concerned.
[0024]
[Embodiment of the Invention] Hereafter, the gestalt of operation of the projector concerning this invention is explained, referring to a drawing.
(Gestalt 1 of operation)
(1) The block diagram 1 of a projector 100 is a block block diagram of the projector 100 concerning the gestalt 1 of operation of this invention.
[0025] This projector 100 mainly consists of control-system 100A, image display system 100B, and projection lens system 100C. Control-system 100A is constituted by the remote control 1 for remote operation, the remote control signal light sensing portion 2, the remote control signal decoding circuit 3, operation part 4, a microcomputer 5, the projection condition presetting memory 6, and the lens adjustment data memory 7.
[0026] This projector 100 is constituted so that two or more projector lenses may be exchangeable, and the data (projector lens correlation data) of projector distance required to project with that magnifying power and the target projection screen size are stored in the projection condition presetting memory 6 in the map format for two or more projector lenses of every concerned. Moreover, the lens adjustment data memory 7 is for holding the controlled variable at the time of adjusting projection lens system 100C (adjustment data).
[0027] If a coordinator sends directions to the body of equipment through remote control 1, it will be received by the remote control signal light sensing portion 2, and the signal from remote control 1 will be decoded in the remote control signal decoding circuit 3, and will be sent to a microcomputer 5. A microcomputer 5 controls the contents of a display of each mechanical component of projection lens system 100C, or the display device 10 of image display system 100B while making an operation required for operation part 4 perform according to the program stored in the internal memory with reference to the contents of storage of the projection condition presetting memory 6 or the lens adjustment data memory 7 based on directions of the received signal. About these detailed contents of control, it mentions later.
[0028] Image display system 100B The light source 8, a condenser lens 9, a display device 10, and this display device 10 The video signal inputted from the OSD signal generating circuit 11 for generating the signal composition

and the display device drive circuit 16 for driving, and the pattern and input screen for adjustment, and making other images display in piles on a screen (on-screen display), the test pattern generating circuit 12, and the outside It has A/D converter 13 for reproducing, the frame rate conversion circuit 14, the number conversion circuit 15 of pixels, etc.

[0029] The electrochromatic display panel of a transparency mold is being used for the display device 10 which is a light valve with the gestalt of this operation. The circuitry for driving this display device 10 with an external video signal is well-known, and it is that example that is shown in drawing 1 . Namely, if a video signal is received from an external terminal, for example, a videocassette recorder, A/D converter 13 will change this into a digital signal, and will send it to the frame rate conversion circuit 14. In the frame rate conversion circuit 14, each synchronous frequency of a vertical synchronization and a horizontal synchronization is changed so that it may agree in the number of display pixels of a display device 10, and the video signal concerned is sent out to the number conversion circuit 15 of pixels. In the number conversion circuit 15 of pixels, after interpolating the data between the pixels of a video signal or carrying out data infanticide according to the number of pixels of a display device 10, it sends to signal composition and the display device drive circuit 16. Signal composition and the display device drive circuit 16 drive a display device 10 according to this video signal, and displays an image.

[0030] On the other hand, it is condensed with a condenser lens 9, incidence of the beam of light injected from the light source 8 is carried out to the image display side of a display device 10, and the transmission image is projected on a screen 30 through the projector lens 17 of projection lens system 100C. Projection lens system 100C consists of the vertical-axes ZURASHI mechanical component 19 for driving the drive motor 23 for vertical-axes ZURASHI in which a projector lens 17 and this projector lens 17 were formed by the vertical and horizontal lens attaching part 18 which it reaches and is held movable in the direction of an optical axis, and this lens attaching part 18, the drive motor 24 for horizontal-axis ZURASHI, the drive motor 25 for focuses, and the drive motor 26 for zoom, respectively, the horizontal-axis ZURASHI mechanical component 20, a focal mechanical component 21, and a zoom mechanical component 22.

[0031] Drawing 2 is a perspective view to show the configuration of the drive in the above-mentioned lens attaching part 18. The lens attaching part 18 consists of the lens maintenance block 181 with which it is equipped with a projector lens 17 exchangeable, the block maintenance frame 182 which holds this lens maintenance block 181 movable perpendicularly (Z direction), a movable carriage seat 183 which holds this maintenance frame 182 movable in the direction of an optical axis (the direction of X), and a fixed plinth 184 which holds this movable carriage seat 183 movable to horizontally (the direction of Y) it intersects perpendicularly with an optical axis further.

[0032] Two rods 1811 and 1812 are set up perpendicularly and these two rods have penetrated possible [sliding] on the top face of the lens maintenance block 181 to the rod attachment component 1821 attached to the block maintenance frame 182. The inferior-surface-of-tongue side of the lens maintenance block 181 also has same maintenance structure, and the lens maintenance block 181 is held by these possible [sliding of a perpendicular direction (Z direction)] with a projector lens 17. The block maintenance frame 182 is held possible [sliding of the direction of X] with the rail which is not illustrated at the movable carriage seat 183, and is held possible [sliding of the direction of Y] with the rail which similarly does not illustrate the movable carriage seat 183.

[0033] As a driving means to each direction, the drive motor 23 for vertical-axes ZURASHI, the drive motor 24 for horizontal-axis ZURASHI, and the drive motor 25 for focuses are used, and bolts 231, 241, and 251 are directly linked with the shaft of those drive motors. Bolts 231, 241, and 251 are screwed in the screwhole prepared in the candidate for a drive, respectively, and can be moved to the shaft orientations of the bolt concerned according to a well-known screw delivery operation.

[0034] Moreover, the drive motor 26 for zoom is held by the maintenance metallic ornaments which are not illustrated at the lens maintenance block 181, by the pinion 261 attached in the driving shaft, it has geared with the gearing 175 for a zoom drive prepared in the peripheral surface of a projector lens 17, the movable cylinder part 176 is rotated by this, and a zoom drive is performed. In addition, although not illustrated especially, the home-position sensor which detects that the lens maintenance block 181, the block maintenance frame 182, and the movable carriage seat 183 are in each criteria location (home position) is formed, and once positioning the movement magnitude of these members in a criteria location, it is controlled by the rotation of each drive motor.

[0035] Although a stepping motor is used and he is trying to control by the gestalt of this operation with the number of driving pulses as each drive motor, a motor with a reduction gear and built-in encoder equipment is used, and it may be made to carry out feedback control by the detection pulse from encoder equipment. Although the zoom drive of a projector lens 17 is controlled similarly, in this case, the mark is given to the peripheral surface of the movable cylinder part 176 of a projector lens 17, and it supposes that it is in a criteria location the time of the photoelectrical sensor (un-illustrating) arranged in the predetermined location detecting this mark, and is controlled by the rotation of the drive motor 26 for zoom on the basis of this.

[0036] In addition, adjustment of a projector 100 displays the message and selection menu according to an advance condition of adjustment on a screen 30 by the projector 100 concerned, and can be set up now by dialogic operation so that it may mention later. A setup by this dialogue formation indicates the menu screen by onscreen one on a screen, and has become the format which a coordinator chooses the item of a menu screen with remote control 1, and specifies. Drawing 3 is ****** which shows the configuration of the manual operation button of this remote control 1. It has the Arrow carbon button 104 for increasing and decreasing the numeric value which moves cursor on the menu button 103 for displaying the input carbon button 102 for making the switch group of remote control 1 decide the power button 101 for using projector 100 body as a power source ON, and the contents of an input, and

a menu screen, and a menu screen as shown in this drawing, or is inputted on an input screen etc.
(2) Install in a hole etc. the projector 100 which has a configuration beyond installation of a projector 100, and the procedure of adjustment, and explain to a detail below the procedure of adjusting projection lens system 100C, based on the flow chart of drawing 4 .
[0037] First, before actually attaching, a coordinator is determined by estimate on the basis of a projection screen size about the physical relationship of the projector distance from a screen to a projector 100, and the perpendicular direction of a screen and a projector 100 etc., referring to the sketch of an anchoring location etc. (step S101). These values are for carrying out temporary installation on the spot, and are good at estimate strictly. In addition, since it constitutes so that it may mention later with the gestalt of this operation and the adjustment in a site can make it very easy, although the projector lens with which raises above-mentioned each projection conditions to the precision of several centimeters in the phase of count on this desk in order to make time and effort of adjustment in a site in the former as easy as possible, and it equips also needed to be specified beforehand, it is not required up to there.
[0038] And according to the count result on this desk, temporary installation of the projector 100 is carried out in an installation site (step S102). The lens standard as a projector lens is attached in this phase. And when remote control 1 is operated, a power source is supplied to a projector 100 (step S103) and a menu button 103 is pushed, a microcomputer 5 reads the image data of an automatic setting screen from an internal memory, displays it on a display device 10 through the OSD signal generating circuit 11, and signal composition and a display device drive circuit 16, and is made to project on a screen 30 (step S104).
[0039] What is necessary is just to carry out focal adjustment suitably so that the focus of a screen may suit by remote control actuation while a coordinator views the screen on a screen 30 when a projection screen is hard to see. In addition, in this phase, since the standard lens is still used, it is not necessary to care about the size of an actual projection screen. As mentioned above, the picture signal which reads the image data of predetermined input screens, such as the above-mentioned automatic setting screen, from an internal memory, or shows the result of a predetermined operation is generated, and a microcomputer 5 is only simplified hereafter, saying, "The screen of .. being displayed (on screen)", and expresses making them project on a screen 30.
[0040] Drawing 5 (a) shows an example of the above-mentioned automatic setting screen. In this automatic setting screen 41, ON-OFF of automatic projection conditioning and selection of the projection direction are attained. It is made to move to the location which operates the Arrow carbon button 104 (drawing 3) of remote control 1, and chooses cursor 42, and by pushing the input carbon button 102, the contents are decided and a microcomputer 5 stores the contents of directions in the lens adjustment data memory 7.
[0041] In addition, "Front" in the projection direction and "Rear" show distinction of whether it projects from the screen 30 front, or to project from screen 30 back, and show distinction of whether "Floor" and "Ceiling" install a projector 100 in a floor, or for it to be made an upside-down and to attach in head lining, respectively. These setups determine whether a microcomputer 5 carries out vertical reversal of the image display in a display device 10, or right-and-left reversal is carried out, and it controls to be projected with the right sense on a screen.
[0042] Now, when "Yes" is chosen by the above-mentioned automatic setting screen 41 about automatic projection conditioning, it goes into (step S105:Yes) and automatic setting mode, and the projection condition input screen 43 as shown in drawing 5 (b) below is displayed. A projection screen size inputs the screen 30 with which the hole was equipped per inch here.
[0043] A rough value [in / in projector distance / the above-mentioned step S1] is inputted. A screen vertical position is the height (L4 of drawing 20) from the floor line of the lower limit of a screen 30, and PJ vertical position is the height (L3 of this drawing 20) from the floor line of projector lens 17 core of a projector 100. The actual measurement in a site is inputted about L3 and L4. In addition, a numerical input is made with the Arrow carbon button 104 of remote control 1. If an arrow-head carbon button is besides pushed, a numeric value will become large, and it will become small if an arrow-down carbon button is pushed on the contrary. Moreover, in changing an input item, it pushes a right arrow or a left arrow carbon button.
[0044] A coordinator pushes the input carbon button 102, after the input of these numeric values is completed. Then, it considers that a microcomputer 5 is what the corresponding numerical input completed (step S107: Yes), and the next installation condition data processing is performed (step S108). This installation condition data processing is processing which finds the optimal projector distance required in order to choose the optimal projector lens for the projection conditions set up among the projector lens groups currently prepared for projectors 100 and to obtain the specified screen size concerned with this lens.
[0045] That is, a microcomputer 5 calculates the optimal lens, projector distance, and the amount of vertical-axes ZURASHI based on the presetting data of a numeric value and the projection condition presetting memory 6 inputted from the coordinator. The data (projector lens correlation data) of the map format which shows relation with projector distance required as shown in the next (table 1), in order to obtain a screen size and the screen size concerned for every class of projector lens are beforehand stored in the projection condition presetting memory 6.
[0046]
[Table 1]

投射レンズ相関データマップ

画面サイズ(型)	投射距離							
	固定焦点レンズ				ズームレンズ			
	TYPE−1 (1.2:1)	TYPE−2 (3.3:1)	TYPE−3 (5:1)	TYPE−4 (7:1)	TYPE−5 (1.5〜3:1)		TYPE−6 (3〜5.3:1)	
					最小	最大	最小	最大
50	1480	3815	5896	8530	1637	3176	2096	5431
70	2012	5155	7908	11312	2242	4388	3366	7603
100	2811	7175	10941	15504	3151	6206	5272	10861
120	3347	8525	12968	18305	3756	7419	6542	13033
150	4149	10551	16010	22510	4665	9237	8448	16292
180	4952	12578	19054	26718	5573	11056	10354	19550
200	5487	13930	21084	29524	6178	12268	11624	21722
250	6827	17311	26161	36541	7692	15299	14800	27153
300	8166	20693	31238	43559	9206	18329	17976	32583
350	9505	24075	36317	50579	10720	21360	21152	38014
400	10845	27458	41396	57598	12234	24391	24328	43444
450	12185	30841	46475	64619	13748	27422	27504	48875
500	13525	34223	51554	71639	15261	30452	30680	54305

[0047] A microcomputer 5 searches the projector lens correlation data concerned, in projector distance required in order to obtain the screen size inputted by the input screen of the above-mentioned step S106, is within the limits of the error (for example, 100mm) which can adjust difference with the inputted projector distance, and chooses the nearest thing. For example, when the inputted screen size is [projector distance] 30m (= 3000mm) in 450 inches, it asks for difference (the projector distance of the fixed focus lens of the 450 inches column of the screen size of (Table 1), and 30m), and that from which the difference is set to less than 100mm is searched. In (Table 1), although 30841mm of the projector distance of the projector lens of TYPE2 is the nearest, since there is a difference with the inputted projector distance no less than 841mm and it exceeds far 100mm of errors in which the above-mentioned adjustment is possible, it cannot adopt. Then, with reference to the column of a zoom lens, what has 30m within the limits of the strange good projector distance is searched next. The projector lens of TYPE-6 is equivalent to this in (Table 1). In addition, although the value of 100mm of error range in which the above-mentioned adjustment is possible is beforehand stored in the projection condition presetting memory 6 as range in the cage implement 120 (drawing 18) of a projector 100 mentioned later which can be adjusted, a coordinator may constitute it so that it can be set as arbitration. Moreover, although 30 inputtedm of the projector distance which should be set up must still be sufficient since it carries out adjustable [of the projector distance for obtaining the target projection screen size] continuously within the limits of predetermined in the case of a zoom lens With the gestalt of this operation, it is stored in the amount table of projector lens adjustments used by projector lens regulating processing of the below-mentioned step S112 (Table 2), and the value (30004mm) nearest to 30m is set up as optimal projector distance.

[0048] Next, it asks for the difference delta L of screen - PJ vertical position, i.e., the center of a screen 30, and the perpendicular direction of the optical axis of a projector lens 17. This value can be easily found as deltaL=L4+(Lv/2)-L3. However, Lv is the die length (refer to drawing 20) of the perpendicular direction of a screen. And the result of an operation obtained as mentioned above is displayed on a screen 30 as the result-of-an-operation display screen 44 as shown in drawing 6 (step S109).

[0049] After a check of this result of an operation, a coordinator is reinstalled so that projector distance may be surveyed and the displayed distance concerned may be suited, while exchanging a projector lens for the optimal projector lens. Moreover, it checks from specification whether it is extent which it can complement with vertical-axes ZURASHI adjustment, if that is right, it is not necessary to change especially the height of a projector 100 but, and about vertical difference deltaL, when that is not right, a projector 100 is adjusted so that the difference concerned may become in tolerance about the height of an installation base.

[0050] Then, although a coordinator performs the input of Yes or No about the acknowledgment indicator of the conditioning of the result-of-an-operation display screen 44 (drawing 6), a setup of the displayed projector distance when the height of a projector 100 is changed as mentioned above inputs the projection conditions which returned to step S106 and were newly changed when [a certain] a situation was not able to be carried out, and it repeats the above-mentioned actuation.

[0051] On the other hand, when the purport currently installed as the installation condition at step S111 is checked, it moves to step S112 and projector lens regulating processing is performed. In this projector lens regulating processing, a microcomputer 5 is the processing which adjusts to the optimal image formation condition according to the screen size and the projector distance conditions of having inputted the condition of a projector lens 17

through the vertical-axes ZURASHI mechanical component 19, the focal mechanical component 21, and the zoom mechanical component 22, automatically.

[0052] Drawing 7 is a flow chart which shows the subroutine of this projector lens regulating processing. First, the amount of ** zoom adjustments, the amount of ** focus adjustments, and the amount of ** vertical-axes ZURASHI are acquired from the wearing projector lens by which the check was carried out [above-mentioned], projector distance, and the value of the vertical difference delta L.

[0053] Considering the case where a zoom lens is generally chosen as a projector lens 17, a required dilation ratio is first called for from the ratio of the size and the screen size of a display device 10, and the required focal distance of a projector lens 17 can be found based on the value of this dilation ratio and projector distance. If a focal distance can be found, the amount of focal adjustments will be determined that it will become the location with the general image formation equation of optics since the distance of the projector lens 17 of the direction of an optical axis and a display device 10 can be specified.

[0054] However, if it says more strictly, since the distance of a projector lens 17 and a screen 30 will be changed by focal adjustment, though a projection screen size is also minute, it changes. Therefore, it is more desirable to adjust a zoom and a focus, giving relevance mutually, with a projection screen size not changed, so that focal adjustment may be performed. Then, while the projection screen size has been eternal as mentioned above, according to the property of each projector lens, it asks for the relation between the amount of zoom adjustments for doubling a focus, and the amount of focal adjustments beforehand, and he is trying to store in the projection condition presetting memory 6 by making this into the amount table of projector lens adjustments, and to calculate the amount of zoom adjustments, and the amount of focal adjustments with the gestalt of this operation, referring to this presetting data. As an example of this amount table of projector lens adjustments, a projection screen size is 450 inches and the next (table 2) is a table showing a table in case the projector lens 17 with which it is equipped is TYPE-6.

[0055]

[Table 2]

投射レンズ調整量テーブル

投射レンズ	TYPE-6	
投射画面サイズ(インチ)	450	
投射距離(mm)	ズーム調整量(パルス)	フォーカス調整量(パルス)
27504	p_1	q_1
27604	p_2	q_2
27704	p_3	q_3
⋮	⋮	⋮
30004	p_m	q_m
30104	p_{m+1}	q_{m+1}
⋮	⋮	⋮
48704	p_{n-2}	q_{n-2}
48804	p_{n-1}	q_{n-1}
48875	p_n	q_n

[0056] being concerned (Table 2) — it sets, and the amount of zoom adjustments and the amount of focal adjustments required in order that projector distance may be minced at intervals of 100mm (however, 48804 to 48875mm of the last has fractional spacing of 71mm), may get down from the 27504 shortestmm to the 48875

longestmm and may obtain a 450 inches projection screen in the case of each projector distance are associated and stored.
[0057] The amount of zoom adjustments and the amount of focal adjustments show the amount of drives of the corresponding drive motor with the number of driving pulses from the time of a projector lens 17 being in the location of a home position in each direction. Beforehand, by the simulation by well-known optical count or a well-known computer, these values are calculated for every class of projector lens, and projection screen size, and are stored in the amount table of projector lens adjustments in the above-mentioned projection condition presetting memory 6. In addition, such an amount table of projector lens adjustments is prepared for every projection screen size about the projector lens of each zoom mold.
[0058] With the gestalt of this operation, in the above-mentioned step S110, since it is set as the projector distance of 30004mm so that it may become the projection screen size of 450 inches with the projector lens of TYPE-6, about pm pulse and the amount of focal adjustments, the value of qm pulse can be acquired [amount / of zoom adjustments] from the table concerned. on the other hand, the magnitude of the display screen of a display device 10 should be set to K inches, then dilation ratio M=450 (inch) / K (inch) -- since come out and it is -- the difference of the above-mentioned perpendicular direction -- the amount delta L/M which **(ed) amount deltaL with the dilation ratio M -- a display device 10 -- the optical axis of a projector lens 17 -- receiving -- the above -- what is necessary is just to make it move to the direction and opposite direction which have produced difference
[0059] With the gestalt of this operation, since vertical-axes ZURASHI is performed by migration of a projector lens 17, this projector lens 17 calculates the amount of adjustments of the drive motor 23 for vertical-axes ZURASHI (the number of driving pulses) so that only the above-mentioned delta L/M may move perpendicularly. In addition, the relation between the number of driving pulses applied to the drive motor 23 for vertical-axes ZURASHI and the amount of axial ZURASHI is known easily. That is, since the number of driving pulses which needs Rota of a stepping motor to rotate one time is known, it is easily computable with the pulse number and die length of one pitch of a bolt 231.
[0060] And based on each control parameter (the number of driving pulses) of the amount of zoom adjustments by which acquisition was carried out [above-mentioned], the amount of focal adjustments, and the amount of vertical-axes ZURASHI adjustments, the drive motors 26, 25, and 23 which correspond through the zoom mechanical component 22, the focal mechanical component 21, and the vertical-axes ZURASHI mechanical component 19, respectively are driven (steps S202-S204), it ends regulating automatically, and a return is carried out to the flow chart of drawing 4 .
[0061] Thus, although the former had taken much time amount by controlling to make it converge on the optimal projection conditions while the coordinator viewed the screen of a screen and repeated independently repeatedly zoom adjustment, focal adjustment, and vertical-axes ZURASHI adjustment, respectively, according to the gestalt of this operation, it can adjust in an instant and large compaction of adjustment time amount can be realized.
[0062] Moreover, while a coordinator makes easy the design of the projection conditions which were performing the desk design conventionally by performing bidirectional actuation according the conditions of a projection screen size and projector distance to an onscreen display from remote control, a drive setup of a projection lens system is also united, it carries out automatically, and a setup of a projection condition design and a projection lens system can be automated by easy alter operation. Since it is mainly realizable only by the addition of a program, these are realizable at cheap cost.
[0063] (Gestalt 2 of operation) The gestalt 1 of above-mentioned operation mainly explained the automatic control of the amount of zoom adjustments, the amount of focal adjustments, and the amount of vertical-axes ZURASHI among adjustments of the projector 100 for obtaining the target screen size. By this, the projection image of coarse-control level will be displayed on a screen 30 within the limits of an installation error. When used for the use application as which so highly precise a projection condition is not required, for example, commercial presentations, above-mentioned adjustment is enough, but when a clear image formation condition is required over the whole screen (for example, when establishing permanently in a hole etc. and showing a Hi-Vision image), still highly precise adjustment is required.
[0064] With the gestalt 2 of this operation, it is in the condition that adjustment (henceforth a "coarse control") of a certain amount of projection conditions was already performed by hand control and the above-mentioned automatic control, and is related with the configuration for performing fine tuning (henceforth "high precision adjustment") of the installation conditions of a projector 100 for the purpose of obtaining still highly precise display image level. In addition, in the gestalt 2 of this operation, since the whole projector 100 configuration is completely the same as drawing 1 , the explanation is omitted and the contents of control in the procedure of high precision adjustment and control-system 100A are explained below.
[0065] Drawing 8 is a flow chart which shows the procedure of the high precision adjustment including the contents of control of a microcomputer 5. First, when a coordinator pushes the menu button 103 of remote control 1, a microcomputer 5 reads the image data of the coarse-control check screen 45 as shown in drawing 9 (a) stored in the internal memory, and is made to display it on a screen 30 (step S301).
[0066] A coordinator judges and inputs the right or wrong of the projection condition in a coarse control, looking at this screen. In the case which is not desirable Choose "No" and it is confirmed whether which conditions are concretely desirable by next inputting the screen location of the right-and-left upper and lower sides to the size and the screen of a screen size. When the projection condition in the coarse-control level which pushes the input carbon button 102 is not desirable, it moves to (step S302:Yes) and step S303, and the readjustment directions

screen 46 as shown in drawing 9 (b) is displayed. While a coordinator views the screen of a screen based on this, the installation location of a projector 100 is adjusted (step S304). Under the present circumstances, it is convenient if it is made to display the correction direction of reinstallation on a screen 30 corresponding to the contents inputted by drawing 9 (a). For example, when a screen size is small, it makes it display, "To lower a little installation location back."

[0067] A coordinator inputs whether it is the no it was satisfied with adjustment on the level of a coarse control of no with reinstallation with the screen of "reinstallation O.K.?" of drawing 9 (b), and when not satisfied, it returns to step S301 once again, the check screen of a coarse-control condition is displayed, and it rechecks [being / S305:No / (step), where / of a projection condition / is bad, and] it. [it] When the input of the satisfied purport is carried out, (step S305:Yes) and the high precision adjustment selection screen 47 as shown below at drawing 9 (c) are displayed (step S306).

[0068] In addition, it faces performing high precision adjustment, and since the above-mentioned step S301 to the step S305 is for only checking the installation condition in coarse-control level, it may be skipped. Here, when asking for still highly precise display image level, a coordinator is the key stroke of remote control 1, and chooses the high precision mode (step S307: Yes).

[0069] Then, a microcomputer 5 generates the test pattern 150 as shown in drawing 10 by the test pattern generating circuit 12, and is displayed on a screen. At this time, the amount input screen 50 of adjustments as doubled and shown in drawing 13 (a) is displayed on the location which seldom laps with the test pattern concerned. As shown in drawing 10 , a test pattern 150 consists of patterns 151-159 for adjustment arranged in the location of a total of nine points of four corners of a rectangle field, the center of this field, and the center of each side (the point by which a projection condition should be adjusted with each patterns 151-159 for adjustment will be hereafter called a coordinating point 1, a coordinating point 2, ..., a coordinating point 9 sequentially from the upper left.).

[0070] And based on each projection condition of each of these patterns 151-159 for adjustment, high precision adjustment is performed as follows. That is, when the installation direction of the projector 100 to a screen 30 does not have right relative relation as it is based on specification, some distortion has arisen rather than the ideal condition, and an actual projection screen cannot fully double a focus to all the corners of a screen, either. Drawing 11 is drawing showing such a projection condition. In addition, distortion of the projection image after [expedient] explaining is exaggerated considerably, and this drawing shows it. Moreover, the patterns 151-159 for adjustment are also omitted, and it is expressing only as the profile.

[0071] It did not understand how many installation conditions since it is adjusted by extent which the flash condition from distortion or a screen seldom already understands in the phase of a coarse control although having turned to the upper right a little than an inclination with a projector 100 ideal in the state of projection of a test pattern 150 like drawing 11 can distinguish once, I could actually adjust in any direction, but time and effort great to this fine tuning in the former was required.

[0072] It enables it to perform these amounts of adjustments easily through the following processes in the gestalt of this operation. Namely, a coordinator views the projection condition of these patterns 151-159 for adjustment, and performs optimum coordination for every coordinating point according to the amount input screen 50 of adjustments of drawing 13 (a) by which it is indicated by onscreen one (step S309).

[0073] Choosing a coordinating point 1 by remote control actuation on the amount input screen 50 of adjustments, and viewing the pattern 151 for adjustment on a screen 30 first, as shown in drawing 12 , the upper left corner of this pattern 151 for adjustment doubles the upper left corner of a screen 30, and a coordinator adjusts a focus, a zoom, and a perpendicular and horizontal location by remote control actuation so that each top-most vertices 1511 and 31 may be in agreement.

[0074] First, in the case of a projection condition [like drawing 11] whose test pattern 150 is, after making a dilation ratio small by zoom adjustment, a focus is doubled about the pattern 151 for adjustment, and it adjusts it so that the surface and left part of the pattern 151 for adjustment concerned may next be in agreement with it of a screen 30 and a shaft may be shifted perpendicularly and horizontally. Thus, information with which each previous amount of adjustments is related when the adjustment about the pattern 151 for adjustment is completed and a coordinator directs a datastore by actuation from remote control 1 (henceforth "the amount data of adjustments") In addition, this amount data of adjustments is stored as an amount of adjustments from the criteria location in the drive of each direction (the number of driving pulses). It is stored in the amount storing table of adjustments as shown in the next table 3 which was related with the coordinating point 1 and prepared in the lens adjustment data memory 7 (step S309).

[0075]

[Table 3]

調整量格納テーブル

調整点	ズーム調整量 (パルス)	フォーカス調整量 (パルス)	垂直軸ズラシ量 (パルス)	水平軸ズラシ量 (パルス)
1	Δpz1	Δpf1	Δpv1	Δph1
2	Δpz2	Δpf2	Δpv2	Δph2
3	Δpz3	Δpf3	Δpv3	Δph3
4	Δpz4	Δpf4	Δpv4	Δph4
5	Δpz5	Δpf5	Δpv5	Δph5
6	Δpz6	Δpf6	Δpv6	Δph6
7	Δpz7	Δpf7	Δpv7	Δph7
8	Δpz8	Δpf8	Δpv8	Δph8
9	Δpz9	Δpf9	Δpv9	Δph9

[0076] After performing the above adjustment actuation about the coordinating point 2 or subsequent ones one by one and completing adjustment about all coordinating points (step S310: Yes), based on the data stored in the amount storing table of adjustments by these processings, the error (installation error) of the installation condition of the current projector 100 and an ideal installation condition is calculated (step S311). In addition, although it is desirable to make it adjust about the adjustment patterns 151, 153, 157, and 159 located in four corners until it makes it in agreement with the corner of a screen 30 as mentioned above, what is necessary is just to make only one corresponding side in agreement about the patterns 152, 154, 156, and 158 for adjustment of the center of each side, and it is good in the amount of adjustments of only a focus about the central pattern 155 for adjustment.

[0077] Calculating at step S311 inclines projector distance, a right-and-left inclination (horizontal inclination), and approximately (vertical inclination), and they are five kinds of adjusted values of a horizontal position and a vertical position, and mentions later about the detail of the contents of an operation. And it is made to display on a screen 30 in step S312 with the result-of-an-operation display screen 51 as shows the above-mentioned result of an operation to drawing 13 (b).

[0078] A coordinator tunes the installation condition of the current projector 100 finely, looking at this display (step S313). This fine tuning is completed, a coordinator views the screen of the test pattern 150 on a screen, high precision adjustment is checked, if it is satisfactory, in the above-mentioned installation position error display screen 51, "high-degree-of-accuracy adjustment continuation No" will be inputted from remote control 1, and this will end high precision adjustment.

[0079] On the contrary, when the need for high precision adjustment is sensed further, "high-degree-of-accuracy adjustment continuation Yes" is inputted from remote control 1, and it returns to step S308, and repeats from the amount input of adjustments by the patterns 151-159 for adjustment. Next, installation condition error data processing of step S311 in the flow chart of above-mentioned drawing 8 is explained.

[0080] Drawing 14 is a flow chart which shows the contents of the installation condition error data processing concerned. First, based on the amount of zoom adjustments and the amount of focal adjustments in each coordinating point memorized by the amount storing table of adjustments of the above (Table 3), the focal distance of a projector lens 17 and the distance to a projector lens 17 and the display screen of a display device 10 are found by the operation (step S401).

[0081] As mentioned above, since the amount of zoom adjustments is expressed with the number of driving pulses, thereby, the amount of drives of the zoom device 171 by the drive motor 26 understands it. Since the amount of drives and a focal distance concerned have relation of 1 to 1, the table or function which shows the relation is stored in the projection condition presetting memory 6 for every class of zoom lens, and a focal distance F can be easily found with a table or a function concerned.

[0082] On the other hand, since the amount of focal adjustments shows the amount of drives of the drive motor 25 for focuses, the movement magnitude from the criteria location of the direction of an optical axis of a projector lens 17 can be known, and, thereby, the distance to a projector lens 17 and the screen of a display device 10 can be acquired. The distance from a projector lens 17 to each coordinating point can be found in a general image formation formula of these values and the optics in a combination lens. Drawing 15 is drawing for [which finds this distance] on the other hand explaining law. In addition, for convenience, it simplifies as a thing of explanation which becomes with two combination lenses, the 1st lens 171 by the side of a display device 10, and the 2nd lens 172 by the side of a screen 30, and the projector lens 17 is shown.

[0083] In this drawing, distance dz is the distance between the 1st and 2nd lens 171,172, and can acquire this value from the above-mentioned amount of zoom adjustments. That is, distance between lenses in a zoom criteria location is set to dz0, and it can be found considering the amount of adjustments as deltadz, then dz=dz0+deltadz. On the other hand, distance df is the distance from a display device 10 to the 1st lens 171, and can be easily found like [this] the above-mentioned distance between lenses by adding the movement magnitude at the time of the adjustment to the distance in a focal criteria location.

[0084] Now, each focal distance of the 1st and 2nd lens is set to f1 and f2, and the relation between F, then a well-known degree type is materialized in the focal distance of a combination lens.

1/F=(1/f1)+(1/f2)- (dz/(f1, f2)) .. ** — again — from the 1st and 2nd lens — respectively — the distance by the 1st principal point 1711 and the 2nd principal point 1721 — SH1 and SH2 — then SH1=(f1, dz)/(f1+f2-dz) ... ** SH2=(-f2, dz)/(f1+f2-dz) ... It becomes **.

[0085] Here, the image formation formula of S', then the following ** type is materialized in the distance which met the optical axis by S, the 2nd principal point 1721, and the image point 1722 on a screen in the distance in alignment with the optical axis of the point 1712 on a display device 10 (object point), and the 1st principal point 1711. 1/S'-1-/S=1/F ... Since it is **S=df+SH1, this is a known value. Moreover, since a focal distance F can be found by ** type, S' can be found if these are substituted for ** type.

[0086] If SH2 is deducted from the value of this S', since the distance ds from the 2nd lens 172 to the image point 1722 of a screen can be found, the distance D in alignment with the optical axis from the object point on a display device 10 to the image point on a screen 30 can be found by adding df and dz to this. in addition — actual — a projector lens 17 — many — although the combination of the two above lenses will be put further together and each type will be called for since it consists of several lens groups, the basic principle for finding distance D is as above-mentioned.

[0087] In return and step S402, operation part 4 performs the above distance calculation to drawing 14 about a coordinating point 1 - a coordinating point 9, and the distance D1-D9 from each display device 10 is found (step S402). And the amount of amendments of projector distance is first calculated with the value of such distance D1-D9. The average to a central distance D5 or each central distance D1-D9 with a coordinating point and a difference with the projector distance by which a current setup is carried out are searched for as an error (step S403).

[0088] Next, the horizontal amount of inclination amendments is obtained from the difference of the distance of some things among distance D1-D9 (step S404). Drawing 16 is a mimetic diagram to show the relative relation to the horizontal direction of a screen 30 and a display device 10. In addition, in order to give explanation easy, it shall be arranged so that the optical axis of a projector lens 17 and the screen of a display device 10 may cross at right angles, and coordinating points 1, 3, 7, and 9 shall correspond to each top-most vertices of a screen 30 here, respectively.

[0089] supposing the distance D1 from a display device 10 to a coordinating point 1 (upper left corner) and the distance D3 by the coordinating point 3 (upper right corner) come to show drawing 16 here — a screen 30 and a display device 10 — horizontal — relative — it inclines, namely, the horizontal amendment angle theta 1 can be easily found by criteria, then the degree type in a coordinating point 1.
Sintheta1= (D3-D1)/Lh — here, Lh is a horizontal distance of a screen 30 (refer to drawing 21), for every size of the, it is a known value and the value of Lh corresponding to the size concerned is beforehand stored in the projection condition presetting memory 6. Since 450 inches is already inputted with the gestalt of this operation, the screen size is searched and the value of Lh is acquired.

[0090] Although the above theta 1 serves as horizontal angles of lead, since the inclination of the built-in screen 30 cannot be changed, of course, the horizontal include angle of a projector 100 will be corrected by the include angle. In addition, to say nothing of the amendment direction of an inclination changing with positive/negative of (D3-D1), when displaying theta 1 the twice which leans a projector 100 leftward by forward and leaning a projector 100 rightward, it distinguishes so that theta 1 may be displayed by negative, and is displayed on the installation position error display screen 51.

[0091] Under the present circumstances, in quest of amendment angle theta1' centering on a coordinating point 1, a horizontal amendment angle, then precision improve the average of theta 1 and theta1' also from a coordinating point 1 and a coordinating point 2 (center of the surface). Then, the amendment angle theta 2 of the perpendicular direction centering on a coordinating point 1 is searched for like an above-mentioned horizontal amendment angle from relation with a coordinating point 7 (lower left corner) (step S405).

[0092] Namely, Sintheta2= (D7-D1)/Lv (however, Lv the die length of a screen perpendicular direction.) It asks by refer to drawing 20 . Thus, after searching for the amendment angle of a horizontal direction and a perpendicular direction, the amount of amendments of the location of horizontal and a perpendicular direction is computed (steps S406 and S407). As shown in drawing 17 , projection image 150" of a test pattern 150 has the shape of a screen 30 and isomorphism, and after correcting the installation include angle of a horizontal direction and a perpendicular direction, after the gap has arisen to the perpendicular direction and the horizontal direction, it should be projected. What is necessary is just to make the parallel displacement only of delta x then, carry out to vertical deltay and a horizontal direction so that top-most-vertices 1511' of the pattern 151 for adjustment and the top-most vertices 31 of a screen 30 may be in agreement.

[0093] This amount of deltax and delta y can be calculated as follows. First, since predetermined zoom adjustment (dilation ratio), focal adjustment, horizontal-axis ZURASHI, and vertical-axes ZURASHI were performed on the top-most vertices 1511 of the pattern 151 for adjustment in projection screen 150' of the test pattern 150 of a basis and it was made in agreement with the top-most vertices 31 of a screen 30, based on each above-mentioned amount of adjustments stored, it can count backward and ask for the top-most vertices 1511 of the first pattern 151 for adjustment from the location of these top-most vertices 31.

[0094] Thus, since present top-most-vertices 1511' was obtained by carrying out include-angle adjustment to the obtained top-most vertices 1511 to a location, it can ask for the location of top-most-vertices 1511' from the positional information of top-most vertices 1511, the amounts theta1 and theta2 of include-angle adjustments, and the corrected projector distance. Since these count progress may be easily drawn by the knowledge of the usual geometry, detailed explanation here is omitted.

[0095] The amounts deltax and delta y of gaps of the level and the perpendicular direction of top-most-vertices 1511' of the pattern 151 for adjustment after the angle correction called for as mentioned above and the top-most vertices 31 of a screen 30 are displayed on the result-of-an-operation display screen 51 of drawing 13 (b) as an amount of amendments of a horizontal position and a vertical position as they are. In addition, although the pattern image in nine coordinating points was adjusted independently, it inclined from the amount of adjustments in the gestalt 2 of this operation projector distance, a right-and-left inclination, and approximately and the five amounts of amendments of a horizontal position and a vertical position were computed to coincidence Since viewing can also perform adjustment of a horizontal and a vertical position, first Projector distance, a right-and-left inclination, Calculate only the amount of amendments of an order inclination, display this, and it is made to reinstall by the coordinator. Then, it is possible to drive the drive motor 23 for vertical-axes ZURASHI and the zoom mechanical component 24 through the vertical-axes ZURASHI mechanical component 19 and the horizontal-axis ZURASHI mechanical component 20 with remote control 1, and to make it also make the corner of the pattern 151 for adjustment in agreement with the corner of a screen 30. In addition, even when each amount of adjustments in these high precision adjustments was stored in the projection condition presetting memory 6 and adjustment is out of order in the future, based on the stored data concerned, it can readjust easily, and is convenient.
[0096] According to the gestalt of this operation, highly precise adjustment is realizable as mentioned above only by adjusting independently, viewing the projection condition of the pattern in each coordinating point. Conventionally, the big part of the service man day of a projector can be closed, and simplification large about the desk design of the projection installation conditions of having required the skillful technique, installation of a projector, and high precision adjustment of a projection lens system, and automation can be attained now.
(Modification) In addition, to say nothing of not being limited to the gestalt of the above-mentioned implementation, this invention can consider the following modifications.
[0097] ** You may constitute from a gestalt 1 of the above-mentioned implementation although the projector lens was inputted from displaying the optimal projector lens and checking this by inputting projection conditions, in addition so that the class of projector lens can be inputted from remote control 1 etc.
** In the gestalt of the above-mentioned implementation, although the case where it was equipped with a zoom lens was explained, a fixed focus mold lens can be considered the same way. However, since zoom adjustment cannot be performed in this case, it cannot be overemphasized that the degree of freedom of adjustment decreases.
[0098] ** It is equipped with one kind of projector lens fixed, and, of course, application of this invention is possible also about the projector which cannot perform lens exchange. In this case, the correlation data only about the projector lens concerned are stored in the projection condition presetting memory 6.
** Although the patterns 151-159 for adjustment were displayed on nine places and the installation condition error amount was calculated with the gestalt 2 of the above-mentioned implementation based on the adjustment data of each pattern in order to ensure high precision adjustment While a plane inclination is specified by three points, since it can ask by adjustment of one of one corners, if the amount of amendments of level and a perpendicular direction can display the pattern for adjustment on the location applicable to at least three corners of a screen 30, the high precision adjustment of it will be attained.
[0099] ** With the gestalt of the above-mentioned implementation, since [a coordinator] the various input screens were indicated by onscreen one and tuning is done by dialogic operation, even if it is not an expert, there is a merit that installation and adjustment can be performed easily. Only irrespective of a screen, the display of such an input screen prepares the liquid crystal display section in a projector body or remote control, and may be made to give the same indication as this.
[0100] ** In addition, in order to reinstall a projector 100 as the result of an operation of the installation condition error in high precision adjustment of the gestalt 2 of operation, the cage implement 120 as shown in drawing 18 may be formed. As for this cage implement 120, the 2nd pedestal 122 is attached in the direction of an optical axis possible [sliding] through the slot 1221 and the bolt 1222 to the 1st pedestal 121. Moreover, the maintenance metallic ornaments 123 are attached in a longitudinal direction pivotable centering on a bolt 1231, and projector 100 body is further attached in the 2nd pedestal 122 pivotable through a bolt 1232 at a cross direction to these maintenance metallic ornaments 123.
[0101] the screw which has the large-sized tongue 1211 is screwed in four corners of the rear face of the 1st pedestal 121 by the screw base 1212, and height is good by the bell-and-spigot condition of this screw -- it is strange and has come. And the amount of inclinations before and behind a projector 100 can be adjusted by doubling an arrow head M2 with the scale 1233 formed in the side face of projector 100 body, and the inclination of right and left of a projector 100 can be exactly adjusted by doubling an arrow head M1 with the scale 1223 formed in the 2nd pedestal 122. Furthermore, the scale 1213 formed in the 1st pedestal 121 can adjust now migration of the direction of an optical axis correctly.
[0102] ** With the gestalt of the above-mentioned implementation, although the liquid crystal panel of a transparency mold was shown as an example as a display device 10, since the invention in this application is in easy-ization of adjustment of projection conditions, if expansion projection can be carried out using a projector lens, the class of display device will not be limited. For example, the liquid crystal panel of a reflective mold is sufficient outside a transparency mold, and the minute mirror of a large number arranged in the shape of a matrix is driven separately, and it does not matter even if it is DMD (digital micro mirror device) which carries out image display by changing the reflective direction. Furthermore, it is applicable also to a setup of the projection conditions in the conventional film projector.

[0103]
[Effect of the Invention] According to this invention, it has the lens driving means which drives a projector lens, a reception means to receive the input of at least one projection condition, a parameter decision means to determine the control parameter of a lens driving means based on said received projection conditions, and the control means that controls said lens driving means based on said determined control parameter as mentioned above. Since a control parameter is determined automatically and a lens driving means drives by this according to it according to the projection conditions received with the reception means, the need that a coordinator carries out troublesome adjustment manually like before becomes absolutely none, and the quick installation and the adjustment of a projector of it are attained only by easy alter operation.
[0104] Moreover, if it has a selection means to choose the projector lens which has a property nearest to the lens property of fulfilling the projection conditions which store the information about the property of two or more projector lenses in the storage means, and were received based on that information as an optimal projector lens, and a display means to display the class of this optimal projector lens, it will become, without a coordinator wavering in selection of a projector lens.
[0105] Furthermore, a reception means to receive the actuation input of a coordinator and the control means which controls a lens driving means based on said received actuation input, A pattern generating means to display a predetermined pattern on two or more locations of the screen of the image display section, Are based on the actuation input made by the coordinator that the image formation condition in each location of two or more of said patterns on which it was projected by said plane of incidence-ed should be adjusted. Based on the controlled variable in said control means for every pattern, it has an operation means to calculate the adjusted value of the installation conditions of a projector body, and a display means to display this adjusted value. By this Since the adjusted value of the installation conditions of a projector body can be obtained only by a coordinator adjusting the image formation condition of each pattern Highly precise installation conditions can be adjusted easily, and while an unskilled serviceman can also secure final-adjustment level easily with high precision in a short time, drastic reduction of installation cost can also be aimed at.

[Translation done.]

* NOTICES *

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damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block block diagram of the projector equipment in the gestalt 1 of operation of this invention.
[Drawing 2] It is drawing showing the configuration of the drive of the projector lens in the above-mentioned projector.
[Drawing 3] It is drawing showing the example of arrangement of the input carbon button of remote control of a projector.
[Drawing 4] It is the flow chart which shows the procedure of the projector installation and adjustment in the gestalt 1 of operation.
[Drawing 5] It is the screen for an input displayed on a screen, and is drawing in which (a) shows an automatic setting screen and (b) shows a projection condition input screen, respectively.
[Drawing 6] It is drawing showing the result-of-an-operation display screen which displays the contents of the projection conditions calculated in the projector 100 interior.
[Drawing 7] It is the flow chart which shows the contents of the projector lens regulating processing in step S112 of the flow chart of drawing 4 .
[Drawing 8] It is the flow chart which shows the procedure of high precision adjustment of the projector installation condition in the gestalt 2 of operation of this invention.
[Drawing 9] It is the screen for an input displayed on a screen in the gestalt 2 of operation, and (a) is drawing in which a coarse-control check screen and (b) show a readjustment directions screen, and (c) shows a high precision adjustment selection screen, respectively.
[Drawing 10] It is drawing showing an example of the test pattern displayed in the gestalt 2 of operation for high precision adjustment.
[Drawing 11] It is drawing showing a condition when the location of the projection screen of the above-mentioned test pattern and the location of a screen are inharmonious.
[Drawing 12] It is drawing showing the condition when doubling the projection location of the pattern for adjustment of a left corner with the corner to which a screen corresponds.
[Drawing 13] The amount input screen of adjustments for (a) to input each amount of adjustments of a projector lens, while a coordinator views a screen about each pattern for adjustment, and (b) are drawings showing the result-of-an-operation display screen in which the result of an operation of the error of the projector installation location obtained by the above-mentioned input is shown, respectively.
[Drawing 14] It is the flow chart which shows the contents of installation condition error data processing of step S311 in the flow chart of drawing 8 .
[Drawing 15] In order to explain the contents of the above-mentioned error data processing, they are a display device, a projector lens, and drawing showing physical relationship with a screen.
[Drawing 16] It is an explanatory view for asking for the relative inclination in the horizontal direction of a display device and a screen.
[Drawing 17] It is drawing showing the example of the physical relationship of the projection image of a test pattern after the relative inclination of a display device and a screen was amended, and a screen.
[Drawing 18] It is drawing showing an example of a cage implement which holds a projector so that adjustment of the inclination of order and right and left may be possible.
[Drawing 19] It is the explanatory view showing the procedure of a projection condition design, installation, and adjustment of the conventional projector.
[Drawing 20] It is drawing showing the physical relationship in the perpendicular direction of a projector and a screen.
[Drawing 21] It is drawing showing the physical relationship in the horizontal direction of a projector and a screen.
[Drawing 22] It is the block diagram showing the configuration of drive control of the projector lens of the conventional projector.
[Description of Notations]
1 Remote Control
2 Remote Control Signal Light Sensing Portion
3 Remote Control Signal Decoding Circuit
4 Operation Part
5 Microcomputer

6 Projection Condition Presetting Memory
7 Lens Adjustment Data Memory
8 Light Source
9 Flux of Light Condenser Lens
10 Display Device
11 OSD Signal Generating Circuit
12 Test Pattern Generating Circuit
13 A/D Converter
14 Frame Rate Conversion Circuit
15 The Number Conversion Circuit of Pixels
16 Signal Composition and Display Device Drive Circuit
17 Projector Lens
18 Lens Attaching Part
19 Vertical-Axes ZURASHI Mechanical Component
20 Horizontal-Axis ZURASHI Mechanical Component
21 Focal Mechanical Component
22 Zoom Mechanical Component
100 Projector
100A Control system
100B Image display system
100C Projection lens system

[Translation done.]

(19)日本国特許庁（ＪＰ）　(12) 公開特許公報（Ａ）　(11)特許出願公開番号
特開2000−81601
（P2000−81601A）
(43)公開日　平成12年３月21日(2000.3.21)

(51)Int.Cl.⁷		識別記号	FI			テーマコード(参考)
Ｇ０２Ｆ	1/13	５０５	Ｇ０２Ｆ	1/13	５０５	
	1/1335			1/1335		
Ｇ０３Ｂ	21/00		Ｇ０３Ｂ	21/00	Ｄ	
Ｇ０９Ｆ	9/00	３６０	Ｇ０９Ｆ	9/00	３６０Ｋ	

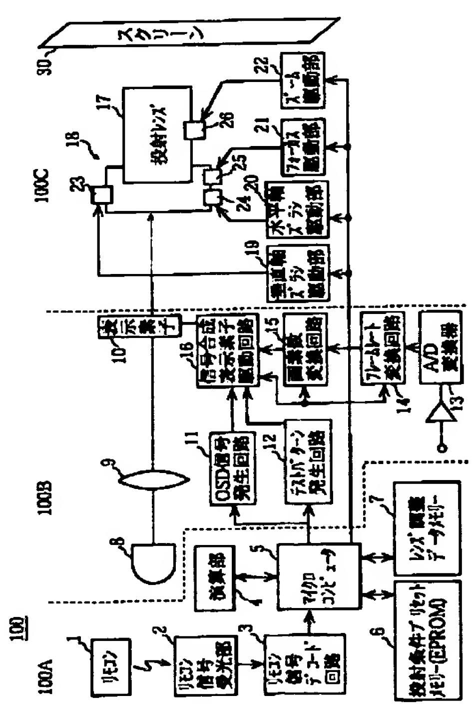
審査請求　未請求　請求項の数14　ＯＬ　（全 19 頁）

(21)出願番号　特願平11−180900
(22)出願日　平成11年６月25日(1999.6.25)
(31)優先権主張番号　特願平10−180129
(32)優先日　平成10年６月26日(1998.6.26)
(33)優先権主張国　日本（ＪＰ）

(71)出願人　000005821
松下電器産業株式会社
大阪府門真市大字門真1006番地
(72)発明者　川島　正裕
大阪府門真市大字門真1006番地　松下電器産業株式会社内
(72)発明者　行天　敬明
大阪府門真市大字門真1006番地　松下電器産業株式会社内
(74)代理人　100090446
弁理士　中島　司朗　（外１名）

(54)【発明の名称】　プロジェクタ

(57)【要約】
【課題】　設置および調整が容易なプロジェクタを提供する。
【解決手段】　リモコン１を介して、マイクロコンピュータ５に投射条件を入力すると、マイクロコンピュータ５は、投射条件プリセットメモリ６に格納されている投射レンズの種類と投影画面サイズと最適投射距離の相関関係を示す相関データを参照して、入力された投射条件を満たす最適投射レンズとそのときの投射距離をスクリーン３０に表示させる。調整者が最適レンズを装着し、最適投射距離にプロジェクタ１００の位置に設置する。マイクロコンピュータ５は、上記投射画面サイズを満足するように投射レンズのズーム駆動量とフォーカス調整量を上記相関データにより演算し、フォーカス駆動部２１、ズーム駆動部２２を介して投射レンズ１７を自動的に駆動する。



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【特許請求の範囲】

【請求項１】　画像表示部に表示された画像を、投射レンズを介して被投射面に投射するプロジェクタであって、
前記投射レンズを駆動するレンズ駆動手段と、
少なくとも一つの投射条件の入力を受け付ける受付手段と、
前記受け付けた投射条件に基づきレンズ駆動手段の制御パラメータを決定するパラメータ決定手段と、
前記決定された制御パラメータに基づき前記レンズ駆動手段を制御する制御手段と、
を備えたことを特徴とするプロジェクタ。

【請求項２】　前記パラメータ決定手段は、複数の投射条件と、各投射条件を満足させるための制御パラメータとの関係を示す相関データを格納する記憶手段を備え、当該相関データに基づいて前記制御パラメータを決定することを特徴とする請求項１記載のプロジェクタ。

【請求項３】　複数種類の投射レンズの交換が可能であり、画像表示部に表示された画像を、装着された投射レンズを介して被投射面に投射するプロジェクタであって、
前記装着された投射レンズを駆動するレンズ駆動手段と、
少なくとも一つの投射条件と、装着する投射レンズの種類のそれぞれの入力を受け付ける受付手段と、
前記受け付けた投射条件と投射レンズの種類に基づきレンズ駆動手段の制御パラメータを決定するパラメータ決定手段と、
前記決定された制御パラメータに基づき前記レンズ駆動手段を制御する制御手段と、
を備えたことを特徴とするプロジェクタ。

【請求項４】　前記パラメータ決定手段は、投射レンズの種類ごとに、複数の投射条件と、各投射条件を満足させるための制御パラメータとの関係を示す相関データを格納する記憶手段を備え、当該相関データに基づいて前記制御パラメータを決定することを特徴とする請求項３記載のプロジェクタ。

【請求項５】　前記投射条件は、投射距離および投射画面サイズを含むことを特徴とする請求項１ないし４のいずれかに記載のプロジェクタ。

【請求項６】　前記レンズ駆動手段は、投射レンズの拡大倍率調整機構およびフォーカス調整機構を備えることを特徴とする請求項１ないし５のいずれかに記載のプロジェクタ。

【請求項７】　前記投射条件は、被投射面中心と投射レンズの光軸との垂直方向の距離に関する情報をさらに含み、前記レンズ駆動手段は、投射レンズと画像表示部の垂直方向の相対位置を変動させる垂直方向移動手段を備えることを特徴とする請求項１ないし６のいずれかに記載のプロジェクタ。

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【請求項８】　複数の投射レンズの交換が可能であり、画像表示部に表示された画像を、装着された投射レンズを介して被投影面に投射するプロジェクタであって、
少なくも一つの投射条件の入力を受け付ける受付手段と、
前記複数の投射レンズの特性に関する情報を格納する記憶手段と、
前記記憶手段に記憶された投射レンズの特性に関する情報に基づき、前記複数の投射レンズの中から前記受け付けた投射条件を満たすレンズ特性に一番近い特性を有する投射レンズを最適投射レンズとして選択する選択手段と、
前記最適投射レンズの種類を表示する表示手段と、
を備えたことを特徴とするプロジェクタ。

【請求項９】　前記投射条件は、投射距離および投射画面サイズを含むと共に、前記記憶手段に格納されている投射レンズの特性情報は、各投射レンズにおいて所定の投射画面サイズを得るために必要な投射距離に関する情報であり、
前記選択手段は、各投射レンズごとに前記投射画面サイズを得るために必要な投射距離を検索し、当該投射距離が前記受け付けた投射距離に一番近いものを最適投射レンズとして選択することを特徴とする請求項８記載のプロジェクタ。

【請求項１０】　前記表示手段は、前記最適投射レンズの種類に加えて、当該投射レンズを使用して、前記受け付けた投射画面サイズを得るために必要な投射距離を表示することを特徴とする請求項８または９に記載のプロジェクタ。

【請求項１１】　画像表示部に表示された画像を、投射レンズを介して被投影面に投影するプロジェクタであって、
前記投射レンズを駆動するレンズ駆動手段と、
調整者の操作入力を受け付ける受付手段と、
前記受け付けた操作入力に基づき前記レンズ駆動手段を制御する制御手段と、
前記画像表示部の画面の複数の位置に所定のパターンを表示させるパターン発生手段と、
前記被投射面に投射された前記複数のパターンの各位置における結像状態を調整すべく調整者によりなされた操作入力による、各パターンごとの前記制御手段における制御量に基づきプロジェクタ本体の設置条件の修正値を演算する演算手段と、
前記演算された修正値を表示する表示手段と、
を備えたことを特徴とするプロジェクタ。

【請求項１２】　前記設置条件は、プロジェクタ本体の水平方向の傾き角と垂直方向の傾き角を含むことを特徴とする請求項１１記載のプロジェクタ。

【請求項１３】　前記所定パターンが表示される複数の位置には、被投射面の４隅のうち少なくとも３隅に対応

する３つの位置が含まれることを特徴とする請求項１１または１２に記載のプロジェクタ。

【請求項１４】　前記受付手段により受け付けるべき内容を示す入力画面を表示する入力画面表示手段と、

前記受付手段により受け付けた調整者の入力内容を前記入力画面上に表示させる表示画面制御手段と、

を備えたことを特徴とする請求項１から１３のいずれかに記載のプロジェクタ。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、液晶パネルなどを利用した画像表示部に形成された画像を、投射レンズを介して投射するプロジェクタに関し、特に当該プロジェクタの投射条件の調整を簡易化する技術に関するものである。

【０００２】

【従来の技術】近年、液晶パネルなどのライトバルブに像を形成し、当該像を投射レンズを介してスクリーン上に投射する、いわゆるライトバルブタイプのプロジェクタが普及しつつある。このようなプロジェクタをホールなどの施設に設置する場合には、従来は、図１９に示すような手順で行われていた。

【０００３】同図に示すように当該プロジェクタの設置手順は、大きくわけて事前の机上設計の段階（ステップＳ５０１～Ｓ５０４）と設置現場での実機セッティングの段階（ステップＳ５０５～Ｓ５１０）とに分けることができる。まず、机上設計の段階では、設置現場においてプロジェクタにより投影されるべき画面のサイズ（投射サイズ）を決定し（ステップＳ５０１）、次に、当該プロジェクタの投射レンズからスクリーンまでの距離（投射距離）と、スクリーン上での投射画面とプロジェクタの相対垂直位置関係とを概略設計する（ステップＳ５０２）。

【０００４】図２０、図２１は、スクリーン３００上での投射画面とプロジェクタ２００の相対位置関係を示す側面図および平面図である。図２０においてスクリーン３００からプロジェクタ２００の投射レンズまでの距離Ｌ１が投射距離を示し、また、プロジェクタ２００本体の投射レンズ水平線に対する、スクリーン３００の垂直方向の中央位置の差分の距離Ｌ２が、投射画面とプロジェクタの相対的垂直距離を示している。

【０００５】上述の投射距離Ｌ１、垂直距離Ｌ２については、当該プロジェクタ用に用意されている投射レンズ群の仕様を参照しながら、プロジェクタの設置場所（設置する部屋）のスペース等より調整者が概略決定する。次に、前記の概略設計の結果に従って、プロジェクタごとに用意されている複数の投射レンズより、適当な１つを選択する（ステップＳ５０３）。この際、投射レンズの拡大倍率やズーム機能の有無が選択時の重要な判断材料となる。

【０００６】そして、ズーム機能を有する投射レンズを選択した場合には、そのズーム倍率を決定し、さらに垂直軸ズラシ量を概算する。この垂直軸ズラシ量は、画像が垂直方向の投射位置をスクリーンの位置に合わせるため、投射レンズの光軸に対して、ライトバルブの位置を相対的垂直方向にずらす量であって、上記ステップＳ５０２で求められた画面～プロジェクタ相対垂直距離Ｌ２と拡大倍率から容易に求められる。

【０００７】この求められた軸ズラシ量が、当該プロジェクタの仕様書に記載された最大軸ズラシ量を超える場合には、プロジェクタ２００の下に台２５０をおいて、不足の長さを補償するようにする（ステップＳ５０４）。以上で、プロジェクタの仕様書に基づいた概略の机上設計を完了する。次に、前記概略の机上設計に基づいたプロジェクタ実機での現場のセッティング（設置・調整）について説明する。

【０００８】まず、上記机上設計の結果に基づいて、プロジェクタの位置を決定して設置する（ステップＳ５０５）。この際、机上設計で算出した投射距離に精度よく合わせると共に、プロジェクタ２００本体の設置方向とスクリーン３００との相対的位置関係を精度よく調整する必要がある。ここで、後者の相対的位置関係は、具体的には、プロジェクタ２００本体の設置方向がスクリーン３００の法線方向に対して、水平方向については平行になり、かつ、垂直方向についてはプロジェクタ仕様の固有の設計角度になるように調整することを意味する。

【０００９】前記プロジェクタの位置の設定を行った後、プロジェクタ本体に電源を投入してスクリーンの投射された実際の投射画像を確認する。この際、投射距離の再確認を実測により行うのが、調整画質の性能確保を重要視する場合は一般的である（ステップＳ５０６）。前記の投射画像の確認、投射距離の実測確認でプロジェクタの位置の設定に不備があると判断した場合は、ステップＳ５０５に戻って、プロジェクタの位置設定をやり直す。前記投射画像の確認、投射距離の再確認で問題なしと判断した場合には、ステップＳ５０７に移り、投射レンズがズームタイプの場合は、投射レンズ拡大倍率の調整、いわゆるズーム調整を行い、続けて投射レンズの垂直軸ズラシの調整を行い（ステップＳ５０８）、さらに続けて投射レンズのフォーカスの調整を行う（ステップＳ５０９）。

【００１０】前記のズーム調整、垂直軸ズラシ調整、フォーカス調整は完全に独立した調整ではないため、調整者がスクリーン上の投射画像を確認しながら、これらの調整を適宜行う必要がある。すなわち、ズーム拡大率を変更すると軸ズラシ量やフォーカス調整量が変動するので、これをさらに調整する必要があるので、それらを微調整しながら再度投射画面により確認し、十分でなければ、また、ズーム調整から軸ズラシ量、フォーカス調整を繰り返して、最適な投射条件に収束させる。

【００１１】以上の調整終了後、投射画面の調整結果について、使用用途の画質要求レベルに応じて、画面サイズ、幾何学歪み、画面全面におけるフォーカス性能の均一性の確認を行う（ステップＳ５１０）。この調整結果の確認の段階において、まだ投射状態に問題があれば、再度ステップＳ５０５のプロジェクタの位置設定に戻って、それ以降のプロジェクタの位置の微調整、投射レンズ系の再調整を繰り返し行い、この結果、ステップＳ５１０で、使用用途の画質要求レベルに問題がないと判断された場合には、プロジェクタのセッティング（設置・調整）を完了する。

【００１２】ところで、最近のプロジェクタにおいては、前述したプロジェクタの調整を少しでも簡易化するために投射レンズ系の調整を電動化している例がある。このようなプロジェクタの投射レンズの駆動系の構成例について、図２２を用いて説明する。同図に示すように、投射レンズの駆動システムは、投射レンズ２１０のフォーカス調整機構を電動で駆動するフォーカス駆動部２１１、ズーム調整機構を電動で駆動するズーム駆動部２１２、投射レンズ２１０を垂直方向に移動可能に保持し、垂直軸ズラシを行う垂直軸ズラシ機構２１３、およびこの垂直軸ズラシ機構２１３を電動で駆動する垂直軸ズラシ駆動部２１４とから構成される。

【００１３】前記の投射レンズ系の駆動システムを制御する制御部は、リモートコントロールスイッチ（以下、単に「リモコン」という。）２０１、リモコン信号受光部２０２、リモコン信号デコード回路２０３、マイクロコンピュータ２０５、およびデータメモリ２０６により構成されている。以下、投射レンズ系駆動システムによりフォーカス調整する場合を例にしてプロジェクタ２００の制御動作を説明する。調整者は、スクリーン画面に投影された画像のフォーカス調整状態を確認しながらリモコン２０１のキー操作を行う。リモコン２０１から調整者のキー操作に応じたリモコン制御信号が赤外線信号等の形態で発信され、プロジェクタ本体のリモコン信号受光部２０２に入力される。

【００１４】リモコン信号受光部２０２では、赤外線信号等の形態の発信信号をアナログ電気信号に変換する。アナログ電気信号は、リモコン信号デコード回路２０３にてデジタル信号にデコードされ、マイクロコンピュータ２０５に入力される。マイクロコンピュータ２０５では、入力されたリモコン制御情報に応じたフォーカス制御信号を、フォーカス駆動部２１１に出力する。

【００１５】フォーカス駆動部２１５は、マイクロコンピュータ２０５から受信したフォーカス制御信号に応じて投射レンズ２１０のフォーカス調整機構を駆動することにより、スクリーン上での投射画像のフォーカス状態を可変する。調整者は前記の操作の結果であるスクリーン上でのフォーカス状態の変化を確認しながら、リモコン操作を行い、これにより最適フォーカス状態に設定する。その後、リモコン２０１からの指示により、最適フォーカス補正状態の調整データが、不揮発性のデータメモリ２０６に保管される。

【００１６】ズーム駆動部２１２、垂直軸ズラシ駆動部２１４を駆動制御する場合もリモコン２０１からの一連の操作、信号の制御はフォーカス調整の場合と同様である。

【００１７】

【発明が解決しようとする課題】しかしながら、前記のように投射条件、投射レンズの仕様に合わせ、プロジェクタ本体の位置調整、投射レンズの拡大倍率、フォーカス、軸ズラシの各調整をスクリーン上の目視確認とプロジェクタ本体の手動位置調整、投射レンズの手動調整の組み合わせで行う方法は、上述のように何回も繰り返しながら最適化する必要があり、調整時間、調整精度、調整コストの点で課題があった。そのため、机上設計の段階においても高い精度（数ｃｍの誤差の範囲）で投射条件を設定する必要があり、これにも時間を要していた。

【００１８】このような事情は、投射レンズ系を電動駆動にしたところで、手動よりは便利になったとはいえ、調整者が目視で確認しながら各部を独立に調整しなければならない以上、最適状態への収束のため、同様の手間が必要であることには変わりはない。特に、近年の市場要求を背景として、投影画面の大画面化、高輝度化、高精細度化および特定用途での投射距離の長焦点化、非常設利用等の要求が、大型の高輝度プロジェクタを中心に高まっており、このような大型プロジェクタは、重量が大きいため取付けが容易ではなく、また、大ホールの天井等の設置条件の厳しい場所にセッティングする場合には、上述のように繰り返し調整することは非常に困難である。

【００１９】また、前記高輝度プロジェクタにおいては、投射レンズも固定焦点タイプ、ズームタイプの数種類のオプション選択が一般的となってきており、投影レンズこと投射条件が異なるので、上記設置の最適化のためさらに時間がかかる要因にもなっている。本発明は上述の問題点に鑑みてなされたものであって、特にホールなどへの最適な設置および調整が容易に行えるプロジェクタを提供することを目的とする。

【００２０】

【課題を解決するための手段】上記目的を達成するため、本発明にかかるプロジェクタは、投射レンズを駆動するレンズ駆動手段と、少なくとも一つの投射条件の入力を受け付ける受付手段と、前記受け付けた投射条件に基づきレンズ駆動手段の制御パラメータを決定するパラメータ決定手段と、前記決定された制御パラメータに基づき前記レンズ駆動手段を制御する制御手段とを備えている。これにより、受付手段により受け付けた投射条件によって制御パラメータが自動的に決定され、それにしたがってレンズ駆動手段が駆動されるので、従来のよう

に調整者が手動で面倒な調整をする必要は一切なくなり、迅速な設置および調整が可能となる。

【００２１】ここで、プロジェクタに複数の投射レンズの交換が可能な場合には、装着する投射レンズと投射条件を受け付けて、当該投射レンズに合った制御パラメータを決定するようにすればよい。また、複数の投射レンズの特性に関する情報を記憶手段に格納しておき、その情報に基づき、受け付けた投射条件を満たすレンズ特性に一番近い特性を有する投射レンズを最適投射レンズとして選択する選択手段と、この最適投射レンズの種類を表示する表示手段を備えておれば、調整者が投射レンズの選択に迷うこともなくなる。

【００２２】また、本発明に係るプロジェクタは、調整者の操作入力を受け付ける受付手段と、前記受け付けた操作入力に基づきレンズ駆動手段を制御する制御手段と、画像表示部の画面の複数の位置に所定のパターンを表示させるパターン発生手段と、前記被投射面に投射された前記複数のパターンの各位置における結像状態を調整すべく調整者によりなされた操作入力による、各パターンごとの前記制御手段における制御量に基づき、プロジェクタ本体の設置条件の修正値を演算する演算手段と、この修正値を表示する表示手段とを備えており、これにより、調整者は各パターンの結像状態を調整するだけで、プロジェクタ本体の設置条件の修正値を得ることができ、高精度な設置条件の調整を容易に行うことができる。

【００２３】また、本発明は、受付手段により受け付けるべき内容を示す入力画面を表示する入力画面表示手段と、前記受付手段により受け付けた調整者の入力内容を前記入力画面上に表示させる表示画面制御手段とを備えており、調整者は当該表示画面の内容を見ることにより調整操作を極めて容易に実行することが可能となる。

【００２４】

【発明の実施の形態】以下、図面を参照しながら本発明に係るプロジェクタの実施の形態について説明する。

（実施の形態１）

（１）プロジェクタ１００の構成

図１は、本発明の実施の形態１に係るプロジェクタ１００のブロック構成図である。

【００２５】このプロジェクタ１００は、主に制御系１００Ａ、画像表示系１００Ｂおよび投射レンズ系１００Ｃとからなる。制御系１００Ａは、遠隔操作用のリモコン１、リモコン信号受光部２、リモコン信号デコード回路３、演算部４、マイクロコンピュータ５、投射条件プリセットメモリ６、レンズ調整データメモリ７により構成される。

【００２６】このプロジェクタ１００は、複数の投射レンズが交換可能なように構成されており、投射条件プリセットメモリ６には、当該複数の投射レンズ毎に、その拡大倍率、および目的の投射画面サイズで投射するのに必要な投射距離のデータ（投射レンズ相関データ）がマップ形式で格納されている。また、レンズ調整データメモリ７は、投射レンズ系１００Ｃを調整した際の制御量（調整データ）を保有するためのものである。

【００２７】調整者が、リモコン１を介して指示を装置本体に送ると、リモコン１からの信号は、リモコン信号受光部２で受信され、リモコン信号デコード回路３で解読されて、マイクロコンピュータ５に送られる。マイクロコンピュータ５は、受信した信号の指示に基づき、投射条件プリセットメモリ６やレンズ調整データメモリ７の記憶内容を参照し、内部メモリに格納されたプログラムにしたがって、演算部４に必要な演算を行わせると共に、投射レンズ系１００Ｃの各駆動部や画像表示系１００Ｂの表示素子１０の表示内容を制御する。これらの詳しい制御内容については後述する。

【００２８】画像表示系１００Ｂは、光源８、集光レンズ９、表示素子１０、この表示素子１０を駆動するための信号合成・表示素子駆動回路１６、調整用のパターンや入力画面を発生させて画面上に他の画像に重ねて表示（オン・スクリーン・ディスプレイ）させるためのＯＳＤ信号発生回路１１、テストパターン発生回路１２、外部から入力されたビデオ信号を再生するためのＡ／Ｄ変換器１３、フレームレート変換回路１４、画素数変換回路１５などを備える。

【００２９】ライトバルブである表示素子１０は、本実施の形態では、透過型のカラー液晶パネルを使用している。この表示素子１０を外部のビデオ信号により駆動するための回路構成は、公知のものであり図１に示しているのはその一例である。すなわち、外部の端末、例えばビデオデッキからビデオ信号を受信するとＡ／Ｄ変換器１３は、これをデジタル信号に変換してフレームレート変換回路１４に送る。フレームレート変換回路１４では、垂直同期と水平同期の各同期周波数を表示素子１０の表示画素数に合致するように変換し、当該ビデオ信号を画素数変換回路１５に送出する。画素数変換回路１５では、表示素子１０の画素数に合わせて、ビデオ信号の画素間のデータを補間し、あるいはデータ間引きをした上で信号合成・表示素子駆動回路１６に送る。信号合成・表示素子駆動回路１６は、このビデオ信号に従って表示素子１０を駆動して、画像を表示させる。

【００３０】一方、光源８から射出された光線は、集光レンズ９により集光されて表示素子１０の画像表示面に入射し、その透過像が投射レンズ系１００Ｃの投射レンズ１７を介してスクリーン３０上に投影される。投射レンズ系１００Ｃは、投射レンズ１７と、この投射レンズ１７を、垂直、水平のおよび光軸方向に移動可能に保持するレンズ保持部１８と、このレンズ保持部１８に設けられた垂直軸ズラシ用駆動モータ２３、水平軸ズラシ用駆動モータ２４、フォーカス用駆動モータ２５およびズーム用駆動モータ２６をそれぞれ駆動するための垂直軸

ズラシ駆動部１９、水平軸ズラシ駆動部２０、フォーカス駆動部２１、ズーム駆動部２２とからなる。

【００３１】図２は、上記レンズ保持部１８における駆動機構の構成を示すための斜視図である。レンズ保持部１８は、投射レンズ１７が交換可能に装着されるレンズ保持ブロック１８１と、このレンズ保持ブロック１８１を垂直方向（Ｚ方向）に移動可能に保持するブロック保持枠１８２と、この保持枠１８２を光軸方向（Ｘ方向）に移動可能に保持する移動台座１８３と、この移動台座１８３をさらに光軸と直交する水平方向（Ｙ方向）に移動可能に保持する固定台座１８４とからなる。

【００３２】レンズ保持ブロック１８１の上面には、垂直方向に２本のロッド１８１１、１８１２が立設されており、この２本のロッドが、ブロック保持枠１８２に付設されたロッド保持部材１８２１に摺動可能に貫通されている。レンズ保持ブロック１８１の下面側も同様な保持構造となっており、これらによりレンズ保持ブロック１８１が投射レンズ１７と共に垂直方向（Ｚ方向）に摺動可能に保持される。ブロック保持枠１８２は、図示しないレールにより移動台座１８３にＸ方向に摺動可能に保持され、移動台座１８３も同じく図示しないレールによりＹ方向に摺動可能に保持される。

【００３３】それぞれの方向への駆動手段として、垂直軸ズラシ用駆動モータ２３、水平軸ズラシ用駆動モータ２４、フォーカス用駆動モータ２５が用いられ、それらの駆動モータの軸には、ボルト２３１、２４１，２５１が直結される。ボルト２３１、２４１、２５１は、それぞれ駆動対象に設けられたネジ孔に螺合しており、公知のネジ送り作用により当該ボルトの軸方向に移動させることができる。

【００３４】また、ズーム用駆動モータ２６が、図示しない保持金具によりレンズ保持ブロック１８１に保持されており、その駆動軸に取り付けられたピニオン２６１により、投射レンズ１７の周面に設けられたズーム駆動用歯車１７５に噛合しており、これにより可動筒部１７６を回転させてズーム駆動を行う。なお、特に図示していないが、レンズ保持ブロック１８１、ブロック保持枠１８２、移動台座１８３がそれぞれの基準位置（ホームポジション）にあることを検出するホームポジションセンサが設けられており、これらの部材の移動量は、一旦基準位置に位置決めした後、各駆動モータの回転量によって制御される。

【００３５】本実施の形態では、各駆動モータとして、ステッピングモータを使用し、その駆動パルス数により制御するようにしているが、減速ギヤとエンコーダ装置内蔵のモータを使用し、エンコーダ装置からの検出パルスによりフィードバック制御するようにしてもよい。投射レンズ１７のズーム駆動も同様にして制御されるが、この場合には、例えば、投射レンズ１７の可動筒部１７６の周面にマークを付しておいて、このマークを所定位置に配設された光電センサ（不図示）により検出したときを、基準位置にあるとし、これを基準にしてズーム用駆動モータ２６の回転量により制御される。

【００３６】なお、後述するようにプロジェクタ１００の調整は、当該プロジェクタ１００によりスクリーン３０上に調整の進行状態に応じたメッセージや選択メニューを表示させて、対話形式で設定できるようになっている。この対話形成による設定は、メニュー画面をスクリーン上にオンスクリーン表示し、調整者がリモコン１によりメニュー画面の項目を選択して指定する形式になっている。図３は、このリモコン１の操作ボタンの構成を示す図ある。同図に示すようにリモコン１のスイッチ群には、プロジェクタ１００本体を電源ＯＮにするための電源ボタン１０１、入力内容を確定させるためのインプットボタン１０２、メニュー画面を表示させるためのメニューボタン１０３、メニュー画面上でカーソルを移動し、あるいは入力画面上で入力する数値を増加、減少させるためのアローボタン１０４などが備えられている。

（２）プロジェクタ１００の設置および調整の手順

以上の構成を有するプロジェクタ１００をホールなどに設置して、投射レンズ系１００Ｃを調整する手順を、図４のフローチャートに基づき、以下詳細に説明する。

【００３７】まず、実際に取り付ける前に調整者が、取付け場所の見取り図などを参照しながら、投射画面サイズを基礎として、スクリーンからプロジェクタ１００までの投射距離、スクリーンとプロジェクタ１００の垂直方向の位置関係などについて概算により決定する（ステップＳ１０１）。これらの値は、現場で仮設置するためのものであり、あくまでも概算でよい。なお、従来では、現場での調整の手間をできるだけ容易にするため、この机上計算の段階で、上記各投射条件を数センチメートルの精度まで高め、装着する投射レンズも予め特定する必要があったが、本実施の形態では後述するように現場での調整が極めて容易にできるように構成しているので、そこまでは要求されない。

【００３８】そして、この机上における計算結果に従い、プロジェクタ１００を設置現場に仮設置する（ステップＳ１０２）。この段階では、投射レンズとして標準的なレンズが取り付けられている。そして、リモコン１を操作してプロジェクタ１００に電源を投入して（ステップＳ１０３）、メニューボタン１０３を押すと、マイクロコンピュータ５は、内部メモリから自動設定画面の画像データを読み出して、ＯＳＤ信号発生回路１１、信号合成・表示素子駆動回路１６を介して表示素子１０に表示し、スクリーン３０上に投影させる（ステップＳ１０４）。

【００３９】もし、投射画面が見にくい場合は、調整者がスクリーン３０上の画面を目視しながらリモコン操作により画面のピントが合うように適当にフォーカス調整すればよい。なお、この段階では、まだ標準レンズを使

用しているので実際の投射画面のサイズは気にする必要はない。上述のようにマイクロコンピュータ５が、内部メモリから上記自動設定画面など所定の入力画面の画像データを読み出し、あるいは所定の演算の結果を示す画像信号を生成して、それらをスクリーン３０上に投影させることを、以下、単に「・・の画面を（スクリーンに）表示させる。」と簡略化して表現する。

【００４０】図５（ａ）は、上記自動設定画面の一例を示すものである。この自動設定画面４１には、自動投射条件設定のＯＮ・ＯＦＦと投射方向の選択が可能になっている。リモコン１のアローボタン１０４（図３）を操作してカーソル４２を選択する場所に移動させて、インプットボタン１０２を押すことにより内容が確定され、マイクロコンピュータ５はその指示内容をレンズ調整データメモリ７に格納する。

【００４１】なお、投射方向における「Ｆｒｏｎｔ」「Ｒｅａｒ」は、それぞれ、スクリーン３０前方から投射するか、スクリーン３０後方から投射するかの区別を示しており、「Ｆｌｏｏｒ」「Ｃｅｉｌｉｎｇ」は、プロジェクタ１００を床に設置するか逆さまにして天井に取り付けるかの区別を示している。これらの設定条件により、マイクロコンピュータ５は表示素子１０における画像表示を上下反転させるか、左右反転させるかを決定し、スクリーン上に正しい向きで投射されるように制御する。

【００４２】さて、上記自動設定画面４１により、自動投射条件設定について「Ｙｅｓ」が選択された場合には（ステップＳ１０５：Ｙｅｓ）、自動設定モードに入り、次に図５（ｂ）に示すような投射条件入力画面４３を表示させる。ここで投射画面サイズは、ホールに備え付けたスクリーン３０をインチ単位で入力する。

【００４３】投射距離は、上記ステップＳ１における概算値が入力される。画面垂直位置は、スクリーン３０の下端の床面からの高さ（図２０のＬ４）であり、ＰＪ垂直位置は、プロジェクタ１００の投射レンズ１７中心の床面からの高さ（同図２０のＬ３）である。Ｌ３、Ｌ４については現場での実測値が入力される。なお、数値の入力は、リモコン１のアローボタン１０４によりなされる。この上矢印ボタンを押すと数値が大きくなり、反対に下矢印ボタンを押すと小さくなる。また、入力項目を変更する場合には右矢印もしくは左矢印ボタンを押す。

【００４４】調整者は、これらの数値の入力が終了するとインプットボタン１０２を押す。するとマイクロコンピュータ５は、該当する数値入力が完了したものとみなして（ステップＳ１０７：Ｙｅｓ）、次の設置条件演算処理を実行する（ステップＳ１０８）。この設置条件演算処理は、プロジェクタ１００用に用意されている投射レンズ群のうち、設定された投射条件に最適な投射レンズを選択し、このレンズで当該指定された画面サイズを得るために必要な最適投射距離を求める処理である。

【００４５】すなわち、マイクロコンピュータ５は、調整者からの入力された数値と投射条件プリセットメモリ６のプリセットデータに基づき、最適レンズ、投射距離、垂直軸ズラシ量を演算する。投射条件プリセットメモリ６には、次の（表１）に示すように、投射レンズの種類ごとに画面サイズと当該画面サイズを得るために必要な投射距離との関係を示すマップ形式のデータ（投射レンズ相関データ）が予め格納されている。

【００４６】

【表１】

投射レンズ相関データマップ

画面サイズ(型)	投射距離							
	固定焦点レンズ				ズームレンズ			
	TYPE－1 (1.2:1)	TYPE－2 (3.3:1)	TYPE－3 (5:1)	TYPE－4 (7:1)	TYPE－5 (1.5～3:1)		TYPE－6 (3～5.3:1)	
					最小	最大	最小	最大
50	1480	3815	5896	8530	1637	3176	2096	5431
70	2012	5155	7908	11312	2242	4388	3366	7603
100	2811	7175	10941	15504	3151	6206	5272	10861
120	3347	8525	12968	18305	3756	7419	6542	13033
150	4149	10551	16010	22510	4665	9237	8448	16292
180	4952	12578	19054	26718	5573	11056	10354	19550
200	5487	13930	21084	29524	6178	12268	11624	21722
250	6827	17311	26161	36541	7692	15299	14800	27153
300	8166	20693	31238	43559	9206	18329	17976	32583
350	9505	24075	36317	50579	10720	21360	21152	38014
400	10845	27458	41396	57598	12234	24391	24328	43444
450	12185	30841	46475	64619	13748	27422	27504	48875
500	13525	34223	51554	71639	15261	30452	30680	54305

【００４７】マイクロコンピュータ５は、当該投射レンズ相関データを検索し、上記ステップＳ１０６の入力画面により入力された画面サイズを得るために必要な投射距離の中で、入力された投射距離との差分が調整可能な誤差（例えば、１００mm）の範囲内であって一番近いものを選択する。例えば、入力された画面サイズが４５０インチで投射距離が３０m（＝３０００mm）の場合には、（表１）の画面サイズの４５０インチの欄の固定焦点レンズの投射距離と３０mとの差分を求めて、その差が１００mm以内となるものを検索する。（表１）では、ＴＹＰＥ２の投射レンズの投射距離の３０８４１mmが一番近いが、入力した投射距離との差が８４１mmもあって、上記調整可能な誤差１００mmをはるかに超えるため採用しえない。そこで、次に、ズームレンズの欄を参照して、３０mがその可変な投射距離の範囲内にあるものを検索する。（表１）では、ＴＹＰＥ－６の投射レンズがこれに相当する。なお、上記調整可能な誤差範囲の１００mmの値は、後述するプロジェクタ１００の保持器具１２０（図１８）における調整可能な範囲として予め投射条件プリセットメモリ６内に格納されるが、調整者が、任意に設定できるように構成してもよい。また、ズームレンズの場合、目的の投射画面サイズを得るための投射距離は、所定の範囲内で連続的に可変するのであるから、設定すべき投射距離は、入力された３０mのままでもよい筈であるが、本実施の形態では、後述のステップＳ１１２の投射レンズ自動調整処理で用いる（表２）の投射レンズ調整量テーブルに格納されているものであって、３０mに一番近い値（３０００４mm）を最適投射距離として設定する。

【００４８】次に、画面～ＰＪ垂直位置、すなわち、スクリーン３０の中央と投射レンズ１７の光軸の垂直方向の差分ΔＬを求める。この値は、ΔＬ＝Ｌ４＋（Ｌv／２）－Ｌ３として容易に求まる。但し、Ｌvはスクリーンの垂直方向の長さ（図２０参照）である。そして、上述のようにして得られた演算結果を、図６に示すような演算結果表示画面４４としてスクリーン３０に表示させる（ステップＳ１０９）。

【００４９】調整者は、この演算結果を確認のうえ、投射レンズを最適投射レンズに交換すると共に、投射距離を実測して当該表示された距離に合うように設置しなおす。また、垂直方向の差分ΔＬについては、それが垂直軸ズラシ調整で補完できる程度であるか否かを仕様書から確認し、そうであれば、特にプロジェクタ１００の高さを変える必要はないが、そうでない場合には、プロジェクタ１００を設置台の高さを当該差分が許容範囲内となるように調整する。

【００５０】その後、調整者は、演算結果表示画面４４（図６）の条件設定の確認表示についてＹｅｓかＮｏの入力を行うが、上述のようにプロジェクタ１００の高さを変えたような場合や、表示された投射距離の設定が何らかの事情できなかったような場合には、ステップＳ１０６に戻って、新たに変更された投射条件を入力して、上記動作を繰り返す。

【００５１】一方、ステップＳ１１１で設置条件通りに設置されている旨を確認した場合には、ステップＳ１１２に移って投射レンズ自動調整処理を行う。この投射レンズ自動調整処理では、マイクロコンピュータ５が、垂直軸ズラシ駆動部１９、フォーカス駆動部２１、ズーム駆動部２２を介して、投射レンズ１７の状態を、入力した画面サイズ、投射距離条件に応じた最適な結像状態に自動的に調整する処理である。

【００５２】図７は、この投射レンズ自動調整処理のサブルーチンを示すフローチャートである。まず、上記確認された装着投射レンズ、投射距離、および垂直方向の差分ΔＬの値から、①ズーム調整量、②フォーカス調整量、③垂直軸ズラシ量を取得する。

【００５３】一般的に投射レンズ１７としてズームレンズが選択された場合を考えると、まず、表示素子１０のサイズと画面サイズの比から必要な拡大率が求められ、この拡大率と投射距離の値に基づき投射レンズ１７の必要な焦点距離を求めることができる。焦点距離が求まれば、光学の一般的な結像方程式により、光軸方向の投射レンズ１７と表示素子１０との距離を特定することができるので、その位置になるようにフォーカス調整量を決定される。

【００５４】しかし、より厳密に言えば、フォーカス調整により投射レンズ１７とスクリーン３０との距離が変動するので、投射画面サイズも微小ながら変動する。したがって、投射画面サイズを変えないまま、フォーカス調整を行うようにズームとフォーカスを相互に関連性を持たせながら調整する方が望ましい。そこで、本実施の形態では、上述のように投射画面サイズが不変のまま、フォーカスを合わせるためのズーム調整量とフォーカス調整量との関係を、各投射レンズの特性に応じて予め求め、これを投射レンズ調整量テーブルとして投射条件プリセットメモリ６に格納しておき、このプリセットデータを参照しながらズーム調整量およびフォーカス調整量を求めるようにしている。次の（表２）は、この投射レンズ調整量テーブルの一例として、投射画面サイズが４５０インチであって、装着されている投射レンズ１７がＴＹＰＥ－６の場合のテーブルを示す表である。

【００５５】

【表２】

投射レンズ調整量テーブル

投射レンズ	TYPE-6	
投射画面サイズ(インチ)	450	
投射距離(mm)	ズーム調整量(パルス)	フォーカス調整量(パルス)
27504	p_1	q_1
27604	p_2	q_2
27704	p_3	q_3
⋮	⋮	⋮
30004	p_m	q_m
30104	p_{m+1}	q_{m+1}
⋮	⋮	⋮
48704	p_{n-2}	q_{n-2}
48804	p_{n-1}	q_{n-1}
48875	p_n	q_n

【００５６】当該（表２）において、投射距離が最短の２７５０４ｍｍから最長の４８８７５ｍｍまで１００ｍｍ間隔（但し、最後の４８８０４ｍｍから４８８７５ｍｍまでは端数の７１ｍｍの間隔となっている）で刻まれおり、各投射距離の際に４５０インチの投射画面を得るために必要なズーム調整量とフォーカス調整量が、関連付けられて格納されている。

【００５７】ズーム調整量、フォーカス調整量はそれぞれの方向において投射レンズ１７がホームポジションの位置にあるときから、該当する駆動モータの駆動量をその駆動パルス数で示している。これらの値は、予め公知の光学的計算もしくはコンピュータによるシミュレーションにより、投射レンズの種類および投射画面サイズごとに求められて、上記投射条件プリセットメモリ６内の投射レンズ調整量テーブルに格納されているものである。なお、このような投射レンズ調整量テーブルは、各ズーム型の投射レンズについて投射画面サイズごとに設けられている。

【００５８】本実施の形態では、上記ステップＳ１１０において、ＴＹＰＥ−６の投射レンズにより、投射画面サイズ４５０インチになるように投射距離３０００４ｍｍに設定されているため、当該テーブルからズーム調整量についてはｐｍパルス、フォーカス調整量についてはｑｍパルスの値を得ることができる。一方、表示素子１０の表示画面の大きさをＫインチとすれば、拡大率Ｍ＝４５０（インチ）／Ｋ（インチ）となる筈であるから、上記垂直方向の差分量ΔＬを拡大率Ｍで除した量ΔＬ／Ｍだけ、表示素子１０を投射レンズ１７の光軸に対して、上記差分の生じている方向と反対方向に移動させればよいことになる。

【００５９】本実施の形態では、投射レンズ１７の移動により垂直軸ズラシを実行しているので、この投射レンズ１７が、垂直方向に上記ΔＬ／Ｍだけ移動するように垂直軸ズラシ用駆動モータ２３の調整量（駆動パルス数）を求める。なお、垂直軸ズラシ用駆動モータ２３に加える駆動パルス数と軸ズラシ量の関係は容易に分かる。すなわち、ステッピングモータのロータが１回転するのに必要な駆動パルス数は既知なので、そのパルス数とボルト２３１の１ピッチの長さにより容易に算出できる。

【００６０】そして、上記取得されたズーム調整量、フォーカス調整量、垂直軸ズラシ調整量の各制御パラメータ（駆動パルス数）に基づき、ズーム駆動部２２、フォーカス駆動部２１、垂直軸ズラシ駆動部１９を介してそ

れぞれ該当する駆動モータ２６、２５、２３を駆動し（ステップＳ２０２～Ｓ２０４）、自動調整を終了して図４のフローチャートにリターンする。

【００６１】このように制御することにより、従来では、調整者がスクリーンの画面を目視してズーム調整、フォーカス調整および垂直軸ズラシ調整をそれぞれ独立して何回も繰り返しながら最適な投射条件に収束させるまで多くの時間を要していたが、本実施の形態によれば瞬時に調整でき、調整時間の大幅な短縮を実現することができるものである。

【００６２】また、調整者が投射画面サイズと投射距離の条件をリモコンからオンスクリーン表示による双方向操作を行うことで、従来机上設計を行っていた投射条件の設計を容易にするとともに、投射レンズ系の駆動設定もあわせて自動的に行い、簡単な入力操作で投射条件設計と投射レンズ系の設定が自動化できる。これらは、主にプログラムの追加のみで実現可能なので、安価なコストで実現できる。

【００６３】（実施の形態２）上述の実施の形態１では、目的の画面サイズを得るためのプロジェクタ１００の調整のうち主にズーム調整量、フォーカス調整量、垂直軸ズラシ量の自動制御について説明した。これにより、設置誤差の範囲内で粗調整レベルの投射映像がスクリーン３０上に表示されることになる。それほど高精度の投射状態が要求されない使用用途、例えば、商用のプレゼンテーション用などに使用されるような場合には上述の調整で十分であるが、画面全体にわたり鮮明な結像状態が要求される場合、例えば、ホールなどに常設してハイビジョン画像を上映するような場合には、さらに高精度な調整が要求される。

【００６４】本実施の形態２では、すでに手動や上記の自動制御によりある程度の投射条件の調整（以下、「粗調整」という。）が行われた状態で、さらに高精度の表示映像レベルを得ることを目的としてプロジェクタ１００の設置条件の微調整（以下、「高精度調整」という。）を実行するための構成に関するものである。なお、本実施の形態２においては、プロジェクタ１００の全体構成は、図１と全く同じであるので、その説明は省略し、高精度調整の手順と制御系１００Ａにおける制御内容について以下説明していく。

【００６５】図８は、マイクロコンピュータ５の制御内容を含む高精度調整の手順を示すフローチャートである。まず、調整者がリモコン１のメニューボタン１０３を押すと、マイクロコンピュータ５は、内部メモリに格納された図９（ａ）に示すような粗調整確認画面４５の画像データを読み出してスクリーン３０上に表示させる（ステップＳ３０１）。

【００６６】調整者はこの画面を見ながら、粗調整における投影状態の是非を判断して入力し、好ましくない場合は、「Ｎｏ」を選択し、次に画面サイズの大小やスクリーンに対する左右上下の画面位置を入力することにより具体的にどの条件が好ましくないのかをチェックし、インプットボタン１０２を押す

粗調整レベルでの投影状態が好ましくないとされた場合には（ステップＳ３０２：Ｙｅｓ）、ステップＳ３０３に移って、図９（ｂ）に示すような再調整指示画面４６を表示させる。これに基づき調整者がスクリーンの画面を目視しながらプロジェクタ１００の設置位置を調整する（ステップＳ３０４）。この際、図９（ａ）で入力された内容に対応して再設置の修正方向をスクリーン３０に表示させるようにすれば便利である。例えば、画面サイズが小さい場合には、「設置位置を少し後ろに下げてください。」と表示させる。

【００６７】調整者は、再設置により粗調整のレベルでの調整に満足した否かを、図９（ｂ）の「再設置ＯＫ？」の画面により入力し、満足しない場合には（ステップＳ３０５：Ｎｏ）、もう一度ステップＳ３０１に戻って、粗調整状態の確認画面を表示させて投影状態のどこが悪いのか再チェックする。満足した旨の入力がされた場合には（ステップＳ３０５：Ｙｅｓ）、次に図９（ｃ）に示すような高精度調整選択画面４７が表示される（ステップＳ３０６）。

【００６８】なお、上述のステップＳ３０１からステップＳ３０５までは、高精度調整を実行するに際して、単に粗調整レベルでの設置状態を確認するためのものなので、省略してもよい。ここで、さらに高精度の表示映像レベルを求める場合、調整者はリモコン１のキー操作で、高精度モードを選択し（ステップＳ３０７：Ｙｅｓ）。

【００６９】すると、マイクロコンピュータ５は、テストパターン発生回路１２により図１０に示すようなテストパターン１５０を発生させてスクリーン上に表示させる。このとき、合わせて図１３（ａ）に示すような調整量入力画面５０が、当該テストパターンとあまり重ならない位置に表示される。図１０に示すように、テストパターン１５０は、矩形領域の４つのコーナとこの領域の中央と各辺の中央の計９ポイントの位置に配設された調整用パターン１５１～１５９からなる（以下、各調整用パターン１５１～１５９により投影状態が調整されるべきポイントを左上から順に調整点１、調整点２、・・・、調整点９と呼ぶことにする。）。

【００７０】そして、この各調整用パターン１５１～１５９のそれぞれの投影状態に基づき次のようにして高精度調整が実行される。すなわち、スクリーン３０に対するプロジェクタ１００の設置方向が、仕様書に基づく通りに正しい相対関係になっていない場合には、実際の投影画面は、理想的な状態よりも若干の歪みが生じており、フォーカスも画面の隅々まで十分に合わせることができない。図１１は、このような投影状態を示す図である。なお、同図では説明の便宜上投影画像の歪みをかな

り誇張して示している。また、調整用パターン１５１〜１５９も省略してその輪郭のみで表示している。

【００７１】図１１のようなテストパターン１５０の投影状態では、プロジェクタ１００が理想的な傾きより、やや右上を向いているということが一応判別できるが、粗調整の段階で、すでに歪みやスクリーンからのはみ出し状態があまり分からない程度までには調整されているので、実際に設置状態をどの方向にどの程度だけ調整してよいか分からず、従来ではこの微調整に多大な手間を要していた。

【００７２】本実施の形態においては、これらの調整量を次のような過程を経て容易に行えることができるようにしている。すなわち、調整者は、この調整用パターン１５１〜１５９の投影状態を目視し、オンスクリーン表示されている図１３（ａ）の調整量入力画面５０にしたがって、各調整点ごとに最適調整を実行する（ステップＳ３０９）。

【００７３】調整者は、まず、調整量入力画面５０上でリモコン操作により調整点１を選択して、スクリーン３０上の調整用パターン１５１を目視しながら、図１２に示すように、この調整用パターン１５１の左上コーナ　＊

＊が、スクリーン３０の左上コーナを合わせ、それぞれの頂点１５１１、３１が一致するように、フォーカスとズームおよび垂直・水平方向の位置をリモコン操作により調整する。

【００７４】テストパターン１５０が、図１１のような投影状態の場合は、まず、ズーム調整により拡大率を小さくしてから調整用パターン１５１についてフォーカスを合わせ、次に当該調整用パターン１５１の上辺と左辺がスクリーン３０のそれと一致するように垂直および水平方向に軸をずらすように調整する。このようにリモコン１からの操作により、調整用パターン１５１についての調整が終了して、調整者がデータストアを指示すると、先の各調整量の関する情報（以下、「調整量データ」という。なお、この調整量データは、それぞれの方向の駆動における基準位置からの調整量（駆動パルス数）として格納される。）が調整点１に関連付けられてレンズ調整データメモリ７内に設けられた次の表３に示すような調整量格納テーブルに格納される（ステップＳ３０９）。

【００７５】

【表３】

調整量格納テーブル

調整点	ズーム調整量(パルス)	フォーカス調整量(パルス)	垂直軸ズラシ量(パルス)	水平軸ズラシ量(パルス)
1	Δpz1	Δpf1	Δpv1	Δph1
2	Δpz2	Δpf2	Δpv2	Δph2
3	Δpz3	Δpf3	Δpv3	Δph3
4	Δpz4	Δpf4	Δpv4	Δph4
5	Δpz5	Δpf5	Δpv5	Δph5
6	Δpz6	Δpf6	Δpv6	Δph6
7	Δpz7	Δpf7	Δpv7	Δph7
8	Δpz8	Δpf8	Δpv8	Δph8
9	Δpz9	Δpf9	Δpv9	Δph9

【００７６】以上の調整動作を、順次調整点２以降についても実行し、全ての調整点について調整が終了すると（ステップＳ３１０：Ｙｅｓ）、これらの処理により調整量格納テーブルに格納されたデータに基づき、現在のプロジェクタ１００の設置状態と理想的な設置状態との誤差（設置誤差）を演算する（ステップＳ３１１）。なお、４隅に位置する調整パターン１５１、１５３、１５７、１５９については、上述のようにスクリーン３０のコーナと一致させるまで調整させるのが望ましいが、各辺の中央の調整用パターン１５２、１５４、１５６、１５８については、対応する１辺のみを一致させればよいし、中央の調整用パターン１５５については、フォーカスのみの調整量でよい。

【００７７】ステップＳ３１１で演算されるのは、投射距離、左右傾き（水平方向の傾き）、前後傾き（垂直方向の傾き）、水平位置、垂直位置の５種類の修正値であり、その演算内容の詳細については後述する。そして、ステップＳ３１２において、上記演算結果を図１３（ｂ）に示すような演算結果表示画面５１によりスクリーン３０に表示させる。

【００７８】この表示を見ながら調整者は、現在のプロジェクタ１００の設置状態を微調整する（ステップＳ３１３）。この微調整が終了して調整者がスクリーン上のテストパターン１５０の画面を目視して、高精度調整の確認を行い、満足のいくものであるならば、リモコン１から上記設置位置誤差表示画面５１において「高精度調整継続　Ｎｏ」の入力を行い、これにより高精度調整を終了する。

【００７９】反対に、さらに高精度調整の必要性を感じた場合には、リモコン１から「高精度調整継続　Ｙｅｓ」の入力を行い、ステップＳ３０８に戻って、調整用パターン１５１〜１５９による調整量入力から繰り返

す。次に、上記図8のフローチャートにおけるステップS311の設置状態誤差演算処理について説明する。

【0080】図14は、当該設置状態誤差演算処理の内容を示すフローチャートである。まず、上記（表3）の調整量格納テーブルに記憶されている各調整点におけるズーム調整量およびフォーカス調整量に基づき、投射レンズ17の焦点距離および、投射レンズ17と表示素子10の表示画面までの距離を演算により求める（ステップS401）。

【0081】上述のようにズーム調整量は、駆動パルス数で表されるので、これにより駆動モータ26によるズーム機構171の駆動量が分かる。当該駆動量と焦点距離は1対1の関係になっているので、その関係を示すテーブルもしくは関数をズームレンズの種類ごとに投射条件プリセットメモリ6に格納しておき、当該テーブルもしくは関数により焦点距離Fを容易に求めることができる。

【0082】一方、フォーカス調整量によりフォーカス用駆動モータ25の駆動量が分かるので、投射レンズ17の光軸方向の基準位置からの移動量が分かり、これにより投射レンズ17と表示素子10の画面までの距離を＊得ることができる。これらの値と、組み合わせレンズにおける光学の一般的な結像公式により、投射レンズ17から各調整点までの距離を求めることができる。図15は、この距離を求める一方法を説明するための図である。なお説明の便宜上、投射レンズ17は、表示素子10側の第1レンズ171とスクリーン30側の第2レンズ172の2枚の組み合わせレンズによりなるものとして簡略化して示している。

【0083】同図において、距離dzは第1、第2レンズ171，172間の距離であり、この値は上記ズーム調整量から得ることができる。すなわち、ズーム基準位置でのレンズ間距離をdz0とし、その調整量をΔdzとすれば、dz＝dz0＋Δdzとして求まる。一方、距離dfは、表示素子10から第1レンズ171までの距離であり、これも上記レンズ間距離と同様にフォーカス基準位置での距離に、その調整時の移動量を加算することにより容易に求まる。

【0084】今、第1、第2レンズのそれぞれの焦点距離をf1、f2とし、組み合わせレンズの焦点距離をFとすれば、公知の次式の関係が成立する。

$$1/F=(1/f1)+(1/f2)-(dz/(f1\cdot f2)) \quad \cdot\cdot ①$$

また、第1、第2レンズからそれぞれ第1主点1711、第2主点1721までの距離を、SH1、SH2と※すれば、

$$SH1=(f1\cdot dz)/(f1+f2-dz) \quad \cdot\cdot\cdot ②$$

$$SH2=(-f2\cdot dz)/(f1+f2-dz) \quad \cdot\cdot\cdot ③$$

となる。

【0085】ここで、表示素子10上の点（物点）1712と第1主点1711との光軸に沿った距離をS、第2主点1721とスクリーン上の像点1722までの光軸に沿った距離をS’とすれば、次の④式の結像公式が成立する。

$$1/S'-1/S=1/F \quad \cdot\cdot\cdot ④$$

S＝df＋SH1であるからこれは既知の値である。また、焦点距離Fも①式により求まるので、これらを④式に代入すれば、S’が求まる。

【0086】このS’の値からSH2を差し引けば、第2レンズ172からスクリーンの像点1722までの距離dsが求まるので、これにdfとdzを加算することにより表示素子10上の物点からスクリーン30上の像点までの光軸に沿った距離Dが求まる。なお、実際には、投射レンズ17は、多数枚のレンズ群から構成されているので、上述のような2枚のレンズの組み合わせがさらに組み合わされて各式が求められることになるが、距離Dを求めるための基本原理は上述の通りである。

【0087】図14に戻り、ステップS402において演算部4は、上述のような距離算出を調整点1～調整点9について行い、それぞれの表示素子10からの距離D1～D9を求める（ステップS402）。そして、まずこれらの距離D1～D9の値により、投射距離の補正量を求める。中央の調整点との距離D5もしくは各距離D1～D9までの平均値と、現在設定されている投射距離との差を誤差として求める（ステップS403）。

【0088】次に、距離D1～D9のうち一部のものの距離の差分から水平方向の傾き補正量を得る（ステップS404）。図16は、スクリーン30と表示素子10の水平方向における相対関係を示すための模式図である。なお、ここでは、説明を容易にするため、表示素子10の表示面は、投射レンズ17の光軸に直交するように配設されているものとし、また、調整点1、3、7、9は、それぞれスクリーン30の各頂点に該当するものとする。

【0089】ここで、表示素子10から調整点1（左上隅）までの距離D1と調整点3（右上隅）までの距離D3が図16に示すようになったとすると、スクリーン30と表示素子10との水平方向の相対的な傾き、すなわち水平方向の補正角θ1は、調整点1を基準とすれば、次式によって容易に求まる。

$$Sin\theta 1=(D3-D1)/Lh$$

ここで、Lhはスクリーン30の水平方向の距離であり（図21参照）、そのサイズごとに既知の値であり、当該サイズに対応するLhの値が、予め投射条件プリセットメモリ6内に格納されている。本実施の形態では450インチがすでに入力されているので、そのスクリーン

サイズを検索してＬｈの値を得る。

【００９０】上記θ１が、水平方向の修正角となるが、もちろん、備え付けのスクリーン３０の傾きを変更することはできないので、その角度分だけ、プロジェクタ１００の水平方向の角度を修正することになる。なお、（Ｄ３－Ｄ１）の正負により傾きの補正方向が異なるのはいうまでもなく、例えば、プロジェクタ１００を左向きに傾ける倍には、θ１を正で表示し、プロジェクタ１００を右方向に傾ける場合にはθ１を負で表示するように区別して設置位置誤差表示画面５１に表示される。

【００９１】この際、調整点１と調整点２（上辺中央）からも調整点１を中心にした補正角θ１’を求めてθ１とθ１’の平均値を水平方向の補正角とすれば精度が向上する。その後、調整点１を中心にした垂直方向の補正角θ２を、調整点７（左下隅）との関係から、上述の水平方向の補正角と同様にして求める（ステップＳ４０５）。

【００９２】すなわち、Ｓｉｎθ２＝（Ｄ７－Ｄ１）／Ｌｖ（但し、Ｌｖはスクリーン垂直方向の長さ。図２０参照）により求める。このようにして水平方向と垂直方向の補正角を求めた後、水平方向および垂直方向の位置の補正量を算出する（ステップＳ４０６、Ｓ４０７）。水平方向と垂直方向の設置角度を修正した後は、図１７に示すようにテストパターン１５０の投影画像１５０’’は、スクリーン３０と同形状であって垂直方向と水平方向にずれが生じた状態で投影されている筈である。そこで、例えば、調整用パターン１５１の頂点１５１１’とスクリーン３０の頂点３１とが一致するように垂直方向のΔｙ、水平方向にΔｘだけ平行移動させればよい。

【００９３】このΔｘ、Δｙの量は、次のようにして求めることができる。まず、もとのテストパターン１５０の投影画面１５０’における調整用パターン１５１の頂点１５１１に所定のズーム調整（拡大率）、フォーカス調整、水平軸ズラシ、垂直軸ズラシを行ってスクリーン３０の頂点３１に一致させたのであるから、この頂点３１の位置から、格納されている上記の各調整量に基づいて、最初の調整用パターン１５１の頂点１５１１を逆算して求めることができる。

【００９４】このようにして得られた頂点１５１１に位置に対して、角度調整をすることにより現在の頂点１５１１’を得たのであるから、頂点１５１１の位置情報と角度調整量θ１、θ２ならびに修正された投射距離とから、頂点１５１１’の位置を求めることができる。これらの計算経過は、通常の幾何学の知識により容易に導き得るものなので、ここでの詳細な説明は省略する。

【００９５】以上のようにして、求められた角度補正後の調整用パターン１５１の頂点１５１１’とスクリーン３０の頂点３１との水平・垂直方向のずれ量Δｘ、Δｙが、そのまま水平位置・垂直位置の補正量として図１３（ｂ）の演算結果表示画面５１に表示される。なお、本実施の形態２においては、９個の調整点におけるパターン映像を独立して調整し、その調整量から投射距離、左右傾き、前後傾き、水平位置、垂直位置の５つの補正量を同時に算出したが、水平・垂直位置の調整は目視でも行えるので、まず、投射距離、左右傾き、前後傾きの補正量のみ求めて、これを表示して調整者により再設置させ、その後、リモコン１により垂直軸ズラシ駆動部１９、水平軸ズラシ駆動部２０を介して垂直軸ズラシ用駆動モータ２３、ズーム駆動部２４を駆動して調整用パターン１５１のコーナをスクリーン３０のコーナに一致させるようにすることも可能である。なお、これらの高精度調整における各調整量を、投射条件プリセットメモリー６に格納しておけば、将来調整が狂った場合でも、当該格納されたデータに基づいて容易に再調整でき便利である。

【００９６】以上のように本実施の形態によれば、各調整点におけるパターンの投影状態を目視しながら独立に調整するだけで、高精度な調整を実現することができる。従来、プロジェクタのサービス工数の大きな部分をしめ、熟練技術を要していた投射設置条件の机上設計、プロジェクタの設置、投射レンズ系の高精度調整について大幅な簡易化、自動化を図ることができるようになった。

（変形例）なお、本発明は、上記実施の形態に限定されないのは言うまでもなく、以下のような変形例を考えることができる。

【００９７】①上記実施の形態１では、投射条件を入力することにより、最適投射レンズを表示させ、これを確認することより投射レンズの入力を行ったが、その他リモコン１などから投射レンズの種類を入力できるように構成してもよい。

②上記実施の形態においては、ズームレンズが装着された場合について説明したが、固定焦点型レンズについても同様に考えることができる。ただ、この場合ズーム調整ができないので、調整の自由度が少なくなるのはいうまでもない。

【００９８】③１種類の投射レンズが固定的に装着されており、レンズ交換ができないプロジェクタについても、本発明の適用はもちろん可能である。この場合には、当該投射レンズのみに関する相関データが投射条件プリセットメモリ６に格納される。

④上記実施の形態２では、高精度調整をより確実に行うため、９個所に調整用パターン１５１～１５９を表示させて、個々のパターンの調整データに基づき、設置状態誤差量を演算したが、平面の傾きは３点で特定されると共に、水平・垂直方向の補正量は、いずれかの１つのコーナの調整で求めることができるので、スクリーン３０の少なくとも３個のコーナに該当する位置に調整用パターンを表示することができれば、高精度調整は可能とな

る。

【００９９】⑤上記実施の形態では、各種入力画面をオンスクリーン表示して、調整者が対話形式で、調整作業を進めることとしたので、熟練者でなくても容易に設置・調整ができるというメリットがある。このような入力画面の表示は、スクリーンのみに拘わらず、プロジェクタ本体やリモコンに液晶表示部を設けて、これ同様な表示をさせるようにしてもよい。

【０１００】⑥なお、実施の形態２の高精度調整における設置状態誤差の演算結果通りにプロジェクタ１００を設置しなおすため、図１８に示すような保持器具１２０を設けてもよい。この保持器具１２０は、第１基台１２１に対して、第２基台１２２が長穴１２２１とボルト１２２２を介して光軸方向に摺動可能に取り付けられている。また、第２基台１２２には、保持金具１２３がボルト１２３１を中心に左右方向に回転可能に取り付けられ、さらにこの保持金具１２３に対してプロジェクタ１００本体がボルト１２３２を介して前後方向に回転可能に取り付けられる。

【０１０１】第１基台１２１の裏面の４隅には、ネジ台１２１２に大型つまみ１２１１を有するネジが螺合されており、このネジのねじ込み具合により高さが可変なようになっている。そして、プロジェクタ１００の前後の傾き量は、プロジェクタ１００本体の側面に設けられたスケール１２３３に矢印Ｍ２を合わせることにより調整でき、プロジェクタ１００の左右の傾きは、第２基台１２２に設けられたスケール１２２３に矢印Ｍ１を合わせることにより的確に調整できる。さらに、光軸方向の移動は、第１基台１２１に設けられたスケール１２１３により正確に調整できるようになっている。

【０１０２】⑦上記実施の形態では、表示素子１０として透過型の液晶パネルを例として示したが、本願発明は、投射条件の調整の容易化にあるから、投射レンズを用いて拡大投射できるものであれば、表示素子の種類は、限定されない。例えば、透過型の外、反射型の液晶パネルでもよいし、マトリクス状に配列された多数の微小のミラーを個々に駆動して、反射方向を変更することにより画像表示するＤＭＤ（デジタル・マイクロミラー・デバイス）などであっても構わない。さらには、従来のフィルム映写機における投射条件の設定にも適用可能である。

【０１０３】

【発明の効果】以上のように本発明によれば、投射レンズを駆動するレンズ駆動手段と、少なくとも一つの投射条件の入力を受け付ける受付手段と、前記受け付けた投射条件に基づき、レンズ駆動手段の制御パラメータを決定するパラメータ決定手段と、前記決定された制御パラメータに基づき前記レンズ駆動手段を制御する制御手段とを備えている。これにより、受付手段により受け付けた投射条件によって制御パラメータが自動的に決定され、それにしたがってレンズ駆動手段が駆動されるので、従来のように調整者が手動で面倒な調整をする必要は一切なくなり、簡単な入力操作のみでプロジェクタの迅速な設置および調整が可能となる。

【０１０４】また、複数の投射レンズの特性に関する情報を記憶手段に格納しておき、その情報に基づき、受け付けた投射条件を満たすレンズ特性に一番近い特性を有する投射レンズを最適投射レンズとして選択する選択手段と、この最適投射レンズの種類を表示する表示手段を備えておれば、調整者が投射レンズの選択に迷うこともなくなる。

【０１０５】さらに、調整者の操作入力を受け付ける受付手段と、前記受け付けた操作入力に基づき、レンズ駆動手段を制御する制御手段と、画像表示部の画面の複数の位置に所定のパターンを表示させるパターン発生手段と、前記被投射面に投射された前記複数のパターンの各位置における結像状態を調整すべく調整者によりなされた操作入力による、各パターンごとの前記制御手段における制御量に基づき、プロジェクタ本体の設置条件の修正値を演算する演算手段と、この修正値を表示する表示手段とを備えており、これにより、調整者は各パターンの結像状態を調整するだけでプロジェクタ本体の設置条件の修正値を得ることができるので、高精度な設置条件の調整を容易に行うことができ、熟練していないサービスマンでも容易かつ短時間で高精度に最終調整レベルを確保できると共に設置コストの大幅な削減も図れる。

【図面の簡単な説明】

【図１】本発明の実施の形態１におけるプロジェクタ装置のブロック構成図である。

【図２】上記プロジェクタにおける投射レンズの駆動機構の構成を示す図である。

【図３】プロジェクタのリモコンの入力ボタンの配置例を示す図である。

【図４】実施の形態１におけるプロジェクタ設置・調整の手順を示すフローチャートである。

【図５】スクリーンに表示される入力用の画面であって、（ａ）は、自動設定画面、（ｂ）は、投射条件入力画面をそれぞれ示す図である。

【図６】プロジェクタ１００内部で演算された投射条件の内容を表示する演算結果表示画面を示す図である。

【図７】図４のフローチャートのステップＳ１１２における投射レンズ自動調整処理の内容を示すフローチャートである。

【図８】本発明の実施の形態２におけるプロジェクタ設置状態の高精度調整の手順を示すフローチャートである。

【図９】実施の形態２においてスクリーンに表示される入力用の画面であって、（ａ）は、粗調整確認画面、（ｂ）は、再調整指示画面、（ｃ）は、高精度調整選択画面をそれぞれ示す図である。

【図１０】実施の形態２において高精度調整のため表示されるテストパターンの一例を示す図である。

【図１１】上記テストパターンの投影画面の位置とスクリーンの位置とが不一致な場合の状態を示す図である。

【図１２】左隅の調整用パターンの投影位置をスクリーンの対応するコーナに合わせたときの状態を示す図である。

【図１３】（ａ）は、各調整用パターンについて調整者が、スクリーンを目視しながら投射レンズの各調整量を入力するための調整量入力画面、（ｂ）は、上記入力により得られたプロジェクタ設置位置の誤差の演算結果を示す演算結果表示画面を、それぞれ示す図である。

【図１４】図８のフローチャートにおけるステップＳ３１１の設置状態誤差演算処理の内容を示すフローチャートである。

【図１５】上記誤差演算処理の内容を説明するため表示素子、投射レンズ、スクリーンとの位置関係を示す図である。

【図１６】表示素子とスクリーンの水平方向における相対的な傾きを求めるための説明図である。

【図１７】表示素子とスクリーンの相対的な傾きが補正された後の、テストパターンの投影画像とスクリーンの位置関係の例を示す図である。

【図１８】プロジェクタを前後・左右の傾きの調整が可能なように保持する保持器具の一例を示す図である。

【図１９】従来のプロジェクタの投射条件設計・設置・調整の手順を示す説明図である。

【図２０】プロジェクタとスクリーンとの垂直方向における位置関係を示す図である。

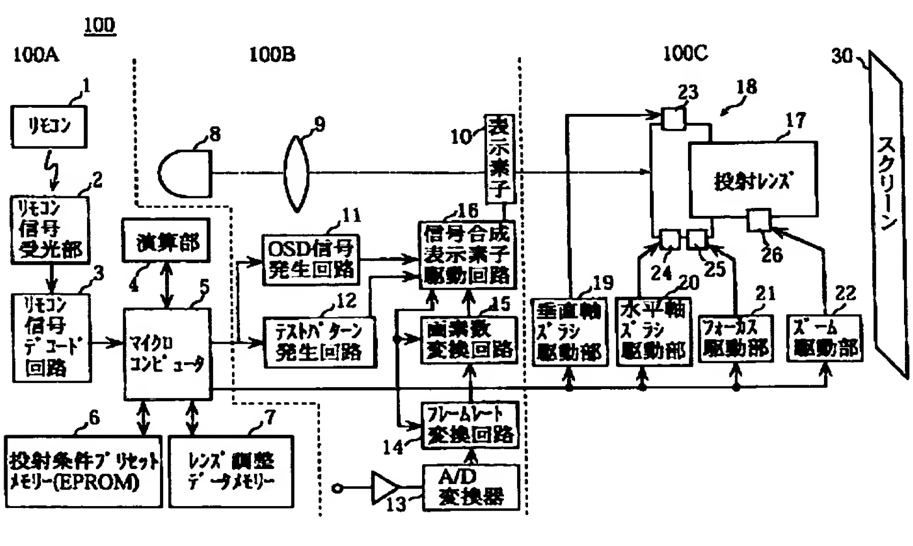
【図２１】プロジェクタとスクリーンとの水平方向における位置関係を示す図である。

【図２２】従来のプロジェクタの投射レンズの駆動制御の構成を示すブロック図である。

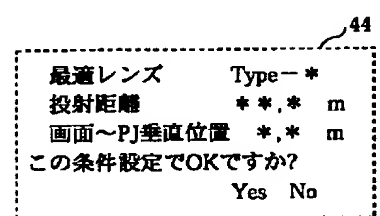
【符号の説明】

１　リモコン
２　リモコン信号受光部
３　リモコン信号デコード回路
４　演算部
５　マイクロコンピュータ
６　投射条件プリセットメモリ
７　レンズ調整データメモリ
８　光源
９　光束集光レンズ
１０　表示素子
１１　ＯＳＤ信号発生回路
１２　テストパターン発生回路
１３　Ａ／Ｄ変換器
１４　フレームレート変換回路
１５　画素数変換回路
１６　信号合成・表示素子駆動回路
１７　投射レンズ
１８　レンズ保持部
１９　垂直軸ズラシ駆動部
２０　水平軸ズラシ駆動部
２１　フォーカス駆動部
２２　ズーム駆動部
１００　プロジェクタ
１００Ａ　制御系
１００Ｂ　画像表示系
１００Ｃ　投射レンズ系

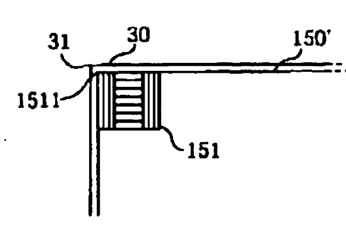
【図１】



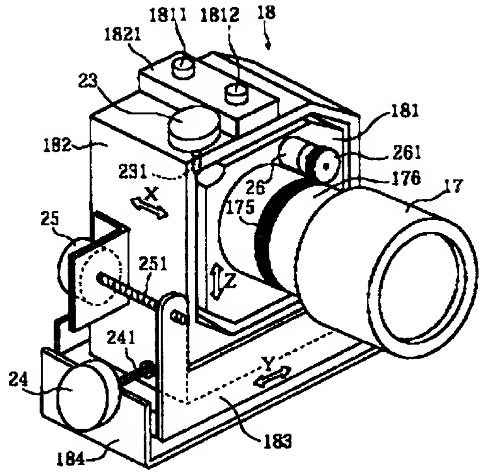
【図６】



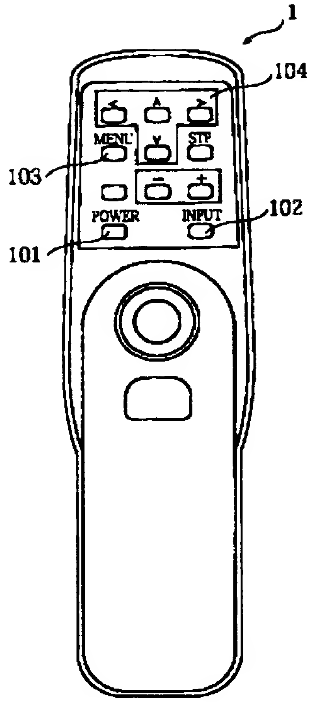
【図１２】



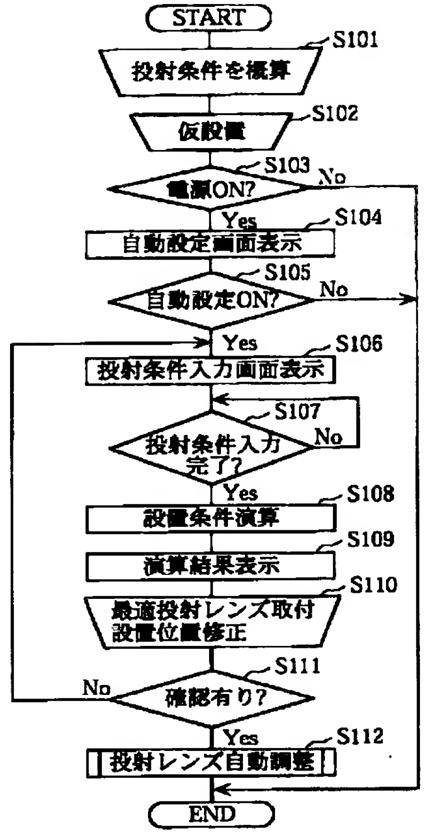
【図2】



【図3】



【図4】



【図5】

(a)

41

自動投射条件設定　Yes　No
投射方向　Front　Rear
　　　　　Floor　Ceiling

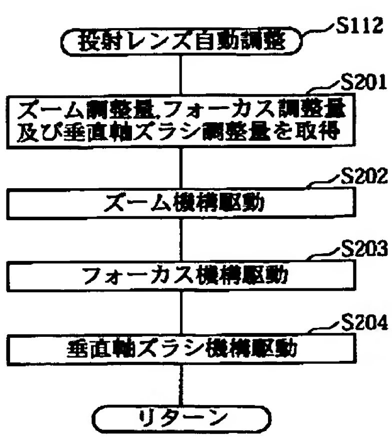
42

(b)

43

投射画面サイズ　□□□　inch
投射距離　□□.□　m
画面垂直位置　□.□　m
PJ垂直位置　□.□　m

【図7】



【図9】

(a)

45

投射状態OK?　Yes　No
画面サイズ　Large、Small
画面位置　Left、Right
　　　　　Upper、Lower

(b)

46

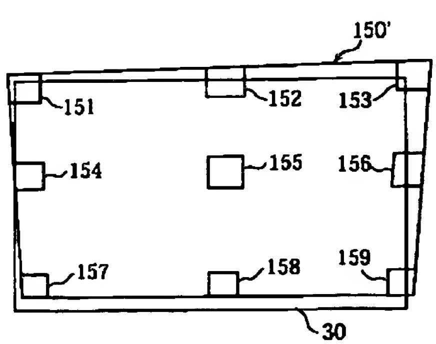
プロジェクタの設置位置を
再調整して下さい
再設置OK?　Yes　No

(c)

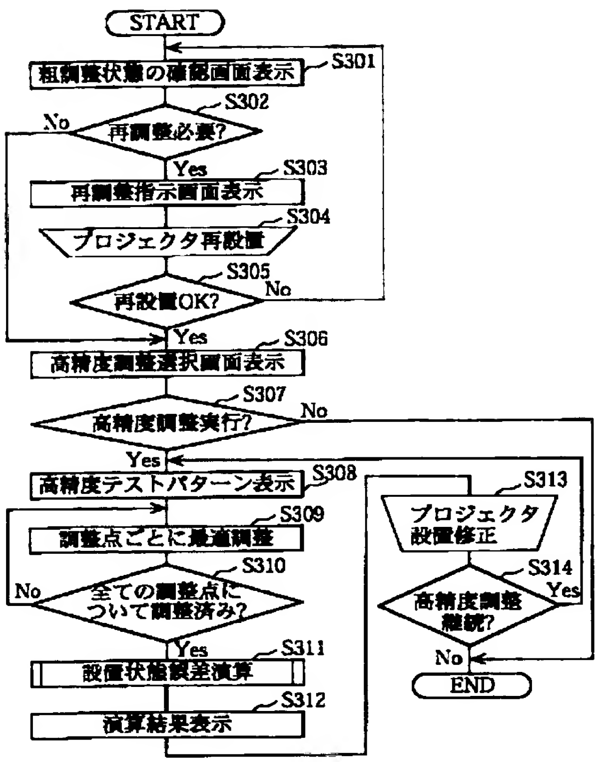
47

高精度調整を実行しますか?
Yes　No

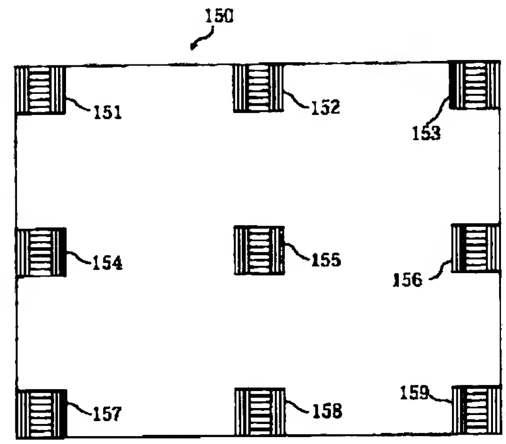
【図11】



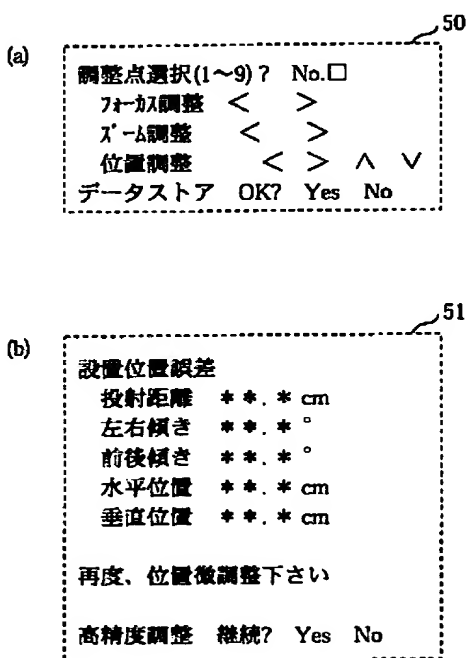
【図8】



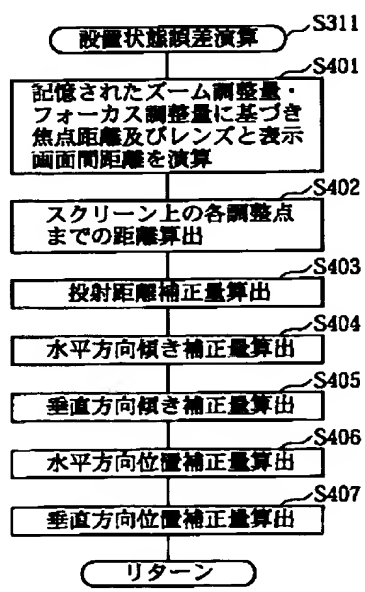
【図10】



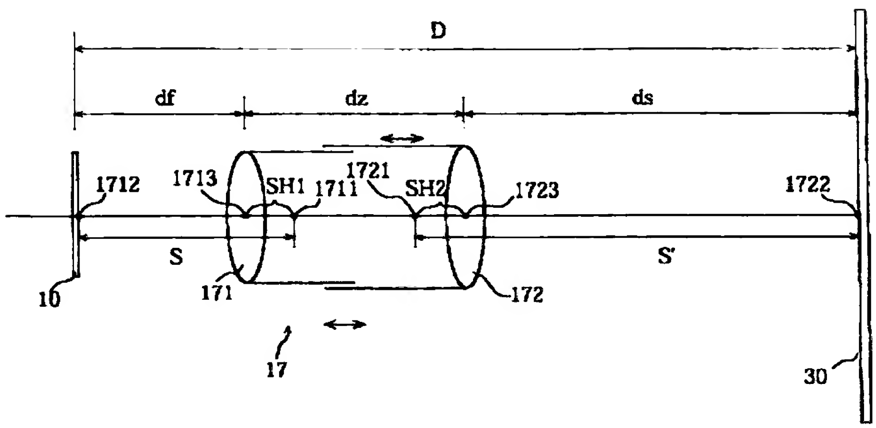
【図13】



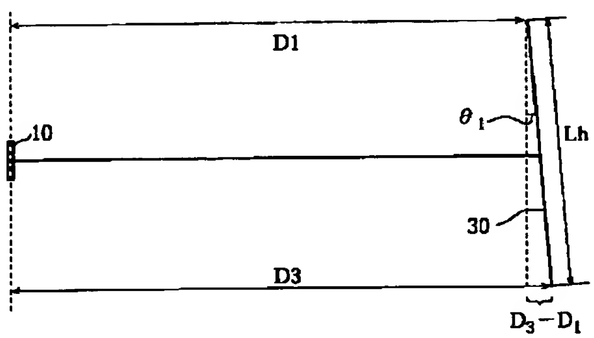
【図14】



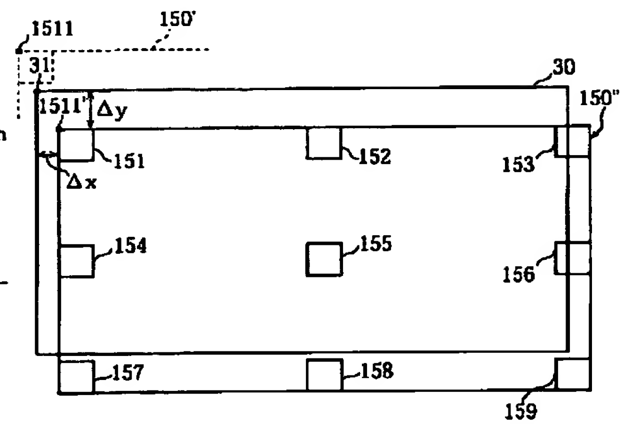
【図15】



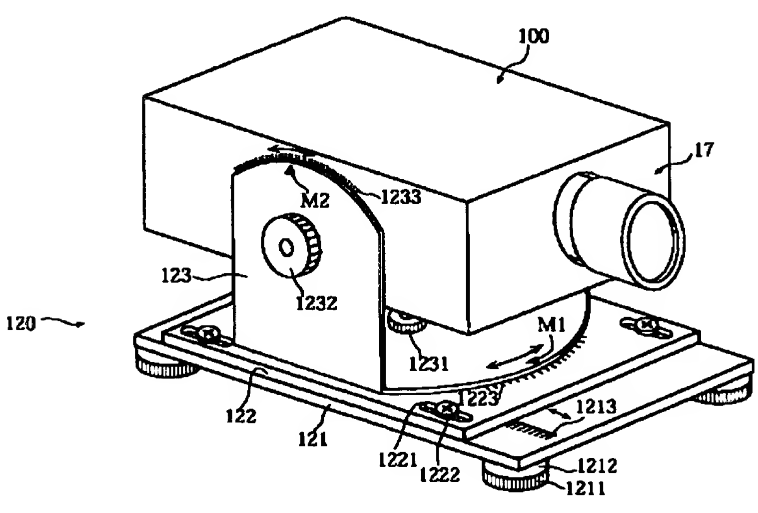
【図16】



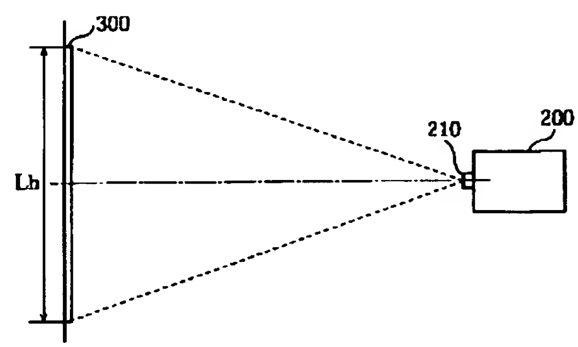
【図17】



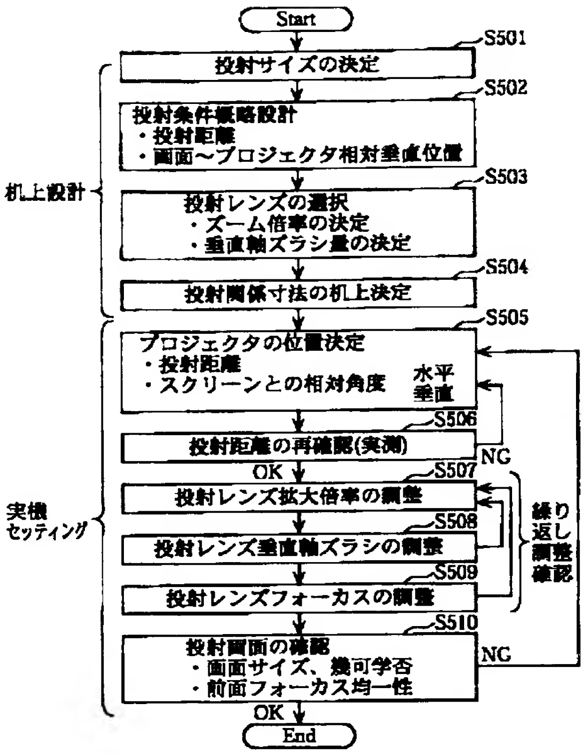
【図18】



【図21】

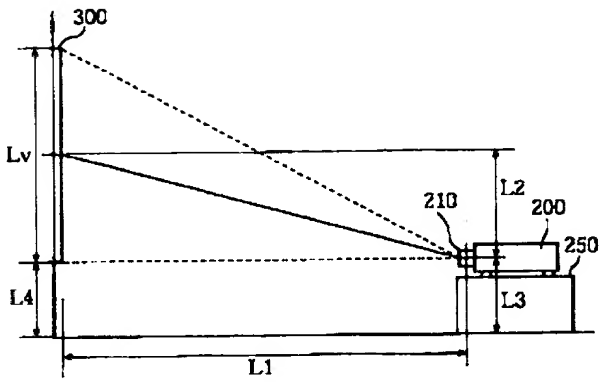


【図19】



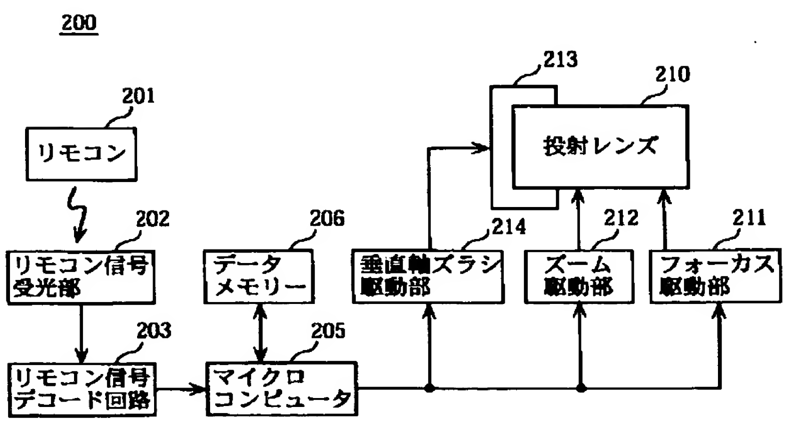
Start
S501
投射サイズの決定
S502
投射条件概略設計
・投射距離
・画面～プロジェクタ相対垂直位置
S503
投射レンズの選択
・ズーム倍率の決定
・垂直軸ズラシ量の決定
S504
投射関係寸法の机上決定
机上設計
S505
プロジェクタの位置決定
・投射距離
・スクリーンとの相対角度
水平
垂直
S506
投射距離の再確認(実測)
NG
OK
S507
投射レンズ拡大倍率の調整
S508
投射レンズ垂直軸ズラシの調整
S509
投射レンズフォーカスの調整
繰り返し調整確認
実機セッティング
S510
投射画面の確認
・画面サイズ、幾可学否
・前面フォーカス均一性
NG
OK
End

【図20】



300
Lv
L2
210
200
250
L4
L3
L1

【図22】



200
201
リモコン
202
リモコン信号受光部
203
リモコン信号デコード回路
206
データメモリー
205
マイクロコンピュータ
213
210
投射レンズ
214
垂直軸ズラシ駆動部
212
ズーム駆動部
211
フォーカス駆動部